THE IRON AGE

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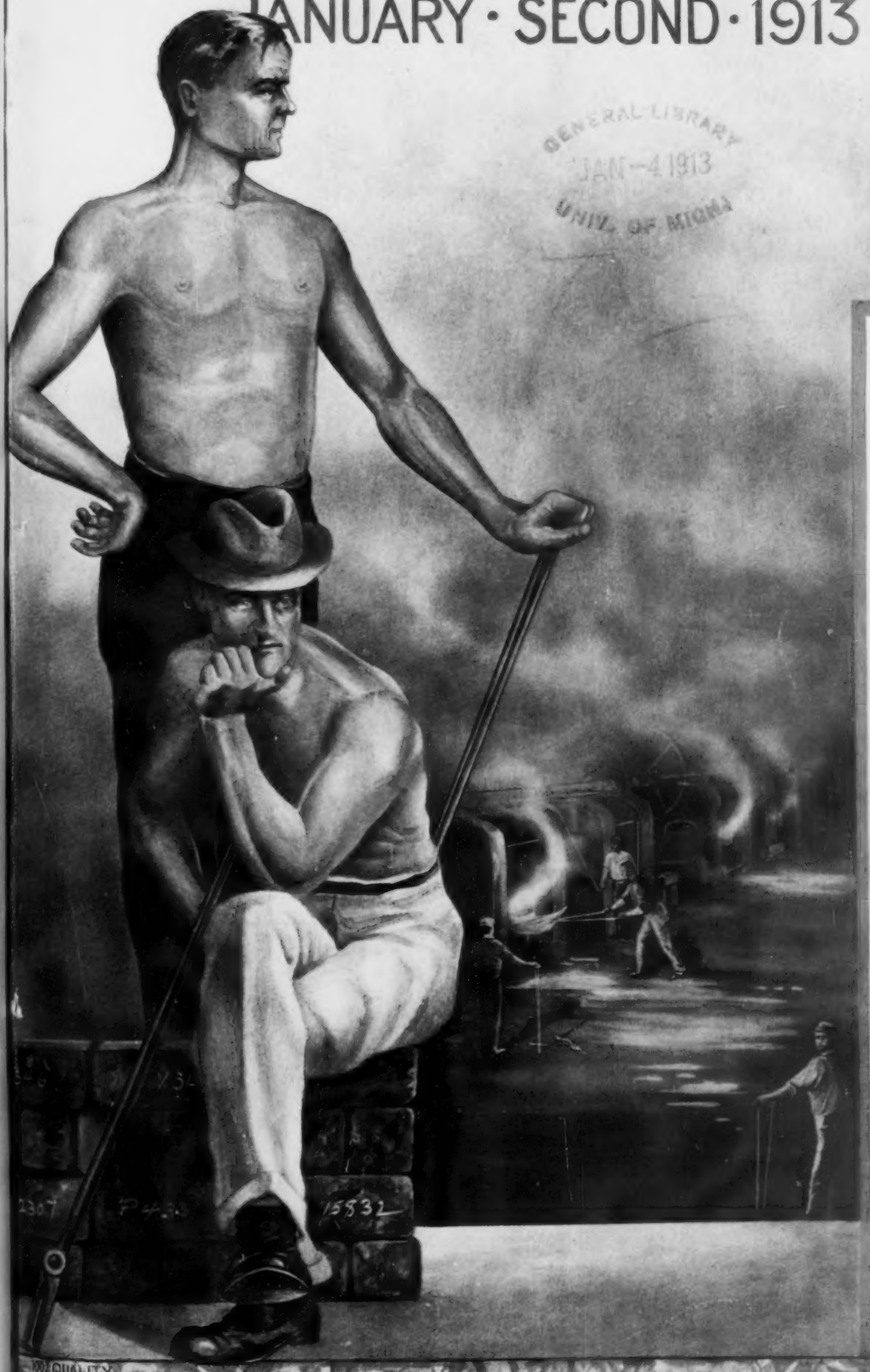

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THE IRON AGE

Established 1855 New York, January 2, 1913 *Vol. 91: No. 1*

A Modern Plant for Automobile Parts

The Works of Dodge Brothers, Detroit, Designed and Equipped for Quantity Manufacture—Forge and Machine Shop Operations on Large Scale

One of the interesting sidelights upon the automobile industry, reflecting not only the magnitude of the manufacturing operations involved but also the manufacturing economies that have made the commercial position of the low priced car unassailable, is presented in the new plant of Dodge Brothers, Detroit. On a site of 25 acres this company has built its plant and is still adding to it. The first operations in the plant were begun in February, 1911. The plant buildings, as indicated on page 3, include a four-story U-shape machine shop and one-story forge and blacksmith shops and heat treatment and brass foundry buildings. The machine shop is of reinforced concrete construction with brick curtain walls, while the other buildings have structural steel skeletons with concrete footings and brick walls.

The plant site is a long narrow strip about 600 ft. wide and the buildings parallel the street frontage with a common length of about 400 ft. At the south end the buildings front on a wide driveway for the use of the several company automobile trucks by which the city haulage is handled, and at the north end face the receiving and shipping railroad track. Between the buildings is a large paved court providing adequate freedom in the handling of materials, which convenience is further augmented by the installation of overhead traveling cranes which traverse the entire length of the courts along the forge shop, blacksmith shop and heat treatment building. Elevators, with an entrance from the court of the machine shop, are arranged so that the 3 and 5-ton trucks may be run into the shop, elevated with their loads to the second, third or fourth floor, where the wide aisles and floor loads have been calculated to permit operating the truck directly to the place where the material is to be loaded or unloaded. The office and power buildings are isolated structures located in front of the rest of the plant.

Although the average daily output of this plant during a recent month was approximately 500 each of completely assembled transmissions, rear axles, drive shafts and steering gears and over 600 steering wheels in addition to similar quantities of front axle and crank-shaft forgings, it was entirely absorbed by one automobile manufacturer. This production has been increased by

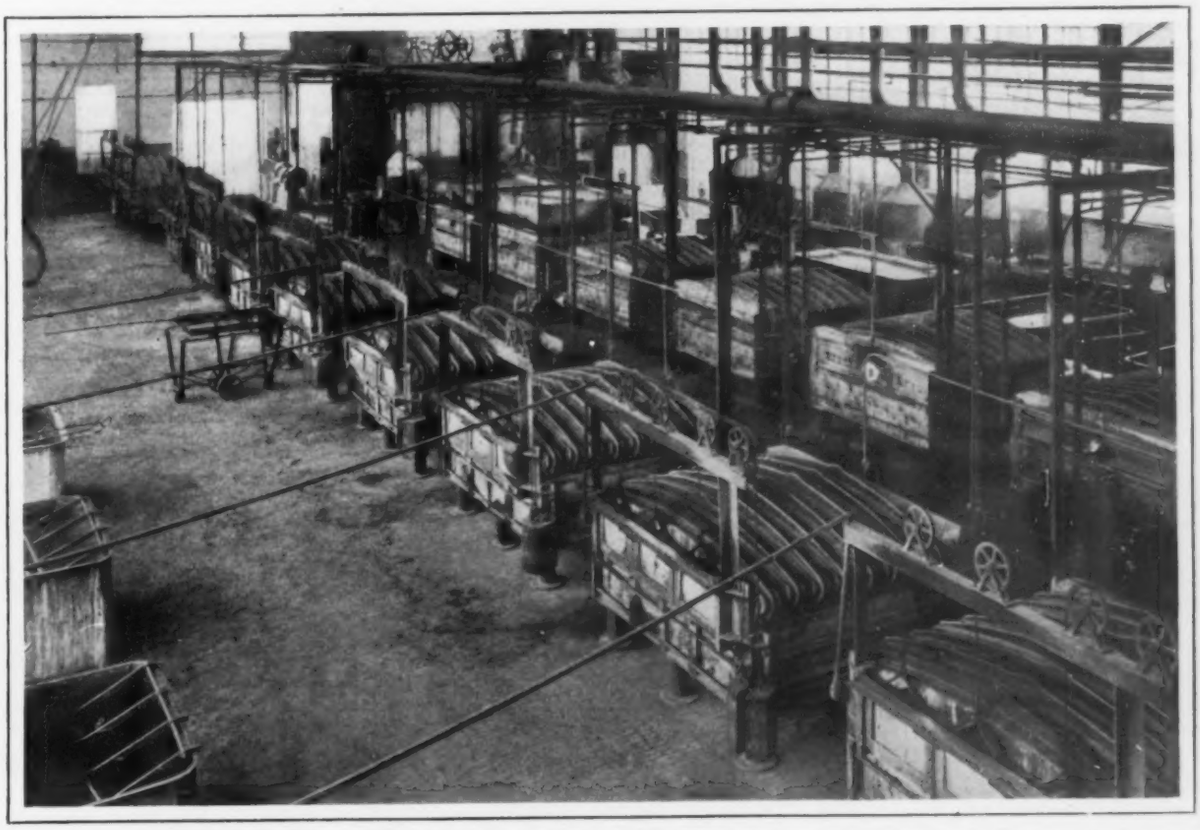


Fig. 1—General View of the Heat-Treatment Room, Showing the Cyanide Furnaces in the Background. The Cyanide Reclaiming Tanks Are Shown Mounted Above Two of the Furnaces, and the Charging Carriage for Placing Shafts in the Furnace Is Also Shown

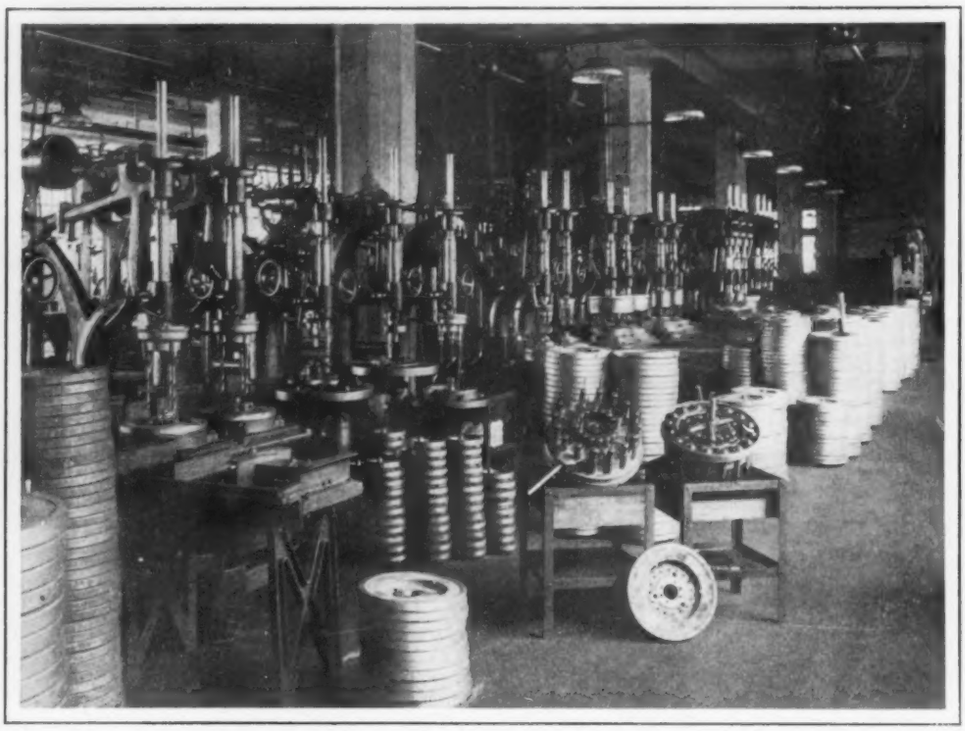


Fig. 2—View of the Flywheel Drilling Department; in the Foreground Are Shown the Geared Attachment for Multiple Drilling and Tapping and a Flywheel Showing the Holes Drilled

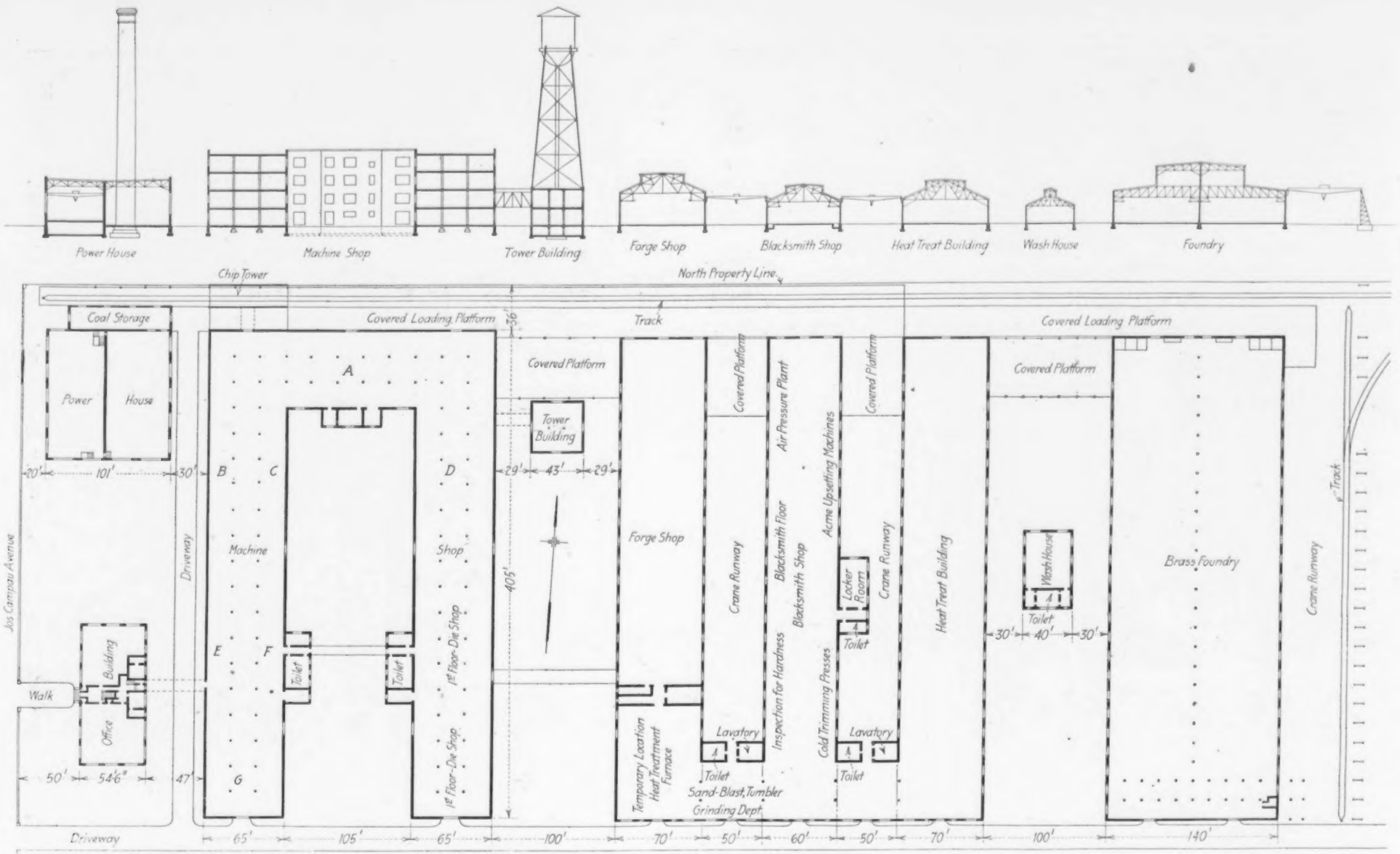
leaps and bounds and the machine shop presents interesting evidences of the evolution in equipment which has come with the demand for a larger output from the same floor space. For example, on the first floor a group of Jones & Lamson flat turret lathes is doing part of the work formerly handled in the lathe department. Multiple drilling and tapping attachments have been devised for single-spindle drills. Pratt & Whitney and Walker vertical spindle grinding machines and Brown & Sharpe vertical spindle milling machines operating continuously have also been substituted for lathe work and the machining of gear blanks mounted in jigs in multiple has replaced individual gear cutting.

Certain multiple drilling and tapping operations are best shown in Fig. 2, which is a view of a portion of the flywheel machining department on the first floor. This illustration shows the group of drills on one side of an aisle flanked on the other side by W. P. Davis turret lathes and Potter & Johnson automatic machines on which flywheels are turned and bored and other transmission castings are machined. For the special features of the drilling, attention is directed to the group of drilling machines which include five 2-spindle and two 3-spindle gang drills and four single drilling machines furnished by the W. F. & John Barnes Company and the Barnes Drill Company. The flywheel placed in the foreground shows the holes that have been drilled and their arrangement, consisting of an outer circle of sixteen ¼-in. holes, a smaller circle of sixteen ⅜-in. holes, and a small circle in the center of four 7/16-in. holes, all to be subsequently tapped.

The multiple drilling device for drilling the two larger bolt circles in one operation is shown in the foreground of this illustration. It is an all geared device consisting of two circles of small pinions, the outer circle driven by a large spur gear; power is communicated from the center driving shank by means of a spider, inside of which the smaller circle of driven pinions engage with a second driving gear keyed to the shank. Although apparently simple, the design of this attachment involves an interesting problem in drilling speeds and power transmission. The effectiveness of the attachment may be illustrated by the fact that on one of the three-spindle gang drilling machines 325 flywheels or 11,700 holes are tapped by two men in 10 hr., the tapping consisting of four 7/16-in. holes with 20 threads, sixteen ⅜-in. holes with 24 threads, and sixteen ¼-in. holes with 24 threads. Sixteen holes are tapped simultaneously, the flywheel riding freely on the taps. This is at the rate of one flywheel per man every three minutes throughout the day.

Fig. 3—Group of Eight Two-Spindle Hartness Flat Turret Lathes for Rapid Production Work of the Character Illustrated by the Pieces Set Up on One of the Metal Tables Provided for the Convenience of the Workmen

This group for the machining of flywheels is typical of the general arrangement of the machine shop, which provides for the segregation of the various general machining operations, as illustrated by many of the ac-



PLAN AND SECTIONAL ELEVATION OF THE WORKS OF DODGE BROTHERS, DETROIT, MICH.

At A: First Floor, Receiving Room; Second Floor, Automatic and Turret Machines; Third Floor, Grinding Department; Fourth Floor, Brass Machining Department. At B: First Floor, Drilling Department; Second Floor, Lathe Department; Third Floor, Gear Generators; Fourth Floor, Assembling. At C: First Floor, Flywheel Machining; Second Floor, Lathe Department; Third Floor, Milling Machines; Fourth Floor, Assembling. At D: First Floor, Automatic and Turret Lathes; Second, Third and Fourth Floors, Storage. At E: First Floor, Blanking Presses; Second Floor, Lathe Department; Third Floor, Gear Cutters; Fourth Floor, Assembling. At F: First Floor, Flat Turret and Automatic Lathes; Second Floor, Lathe Department; Third Floor, Milling Machines; Fourth Floor, Assembling. At G: First Floor, Automobile Garage; Second Floor, Tool Room; Third Floor, Pattern Shop; Fourth Floor, Finished Stock.

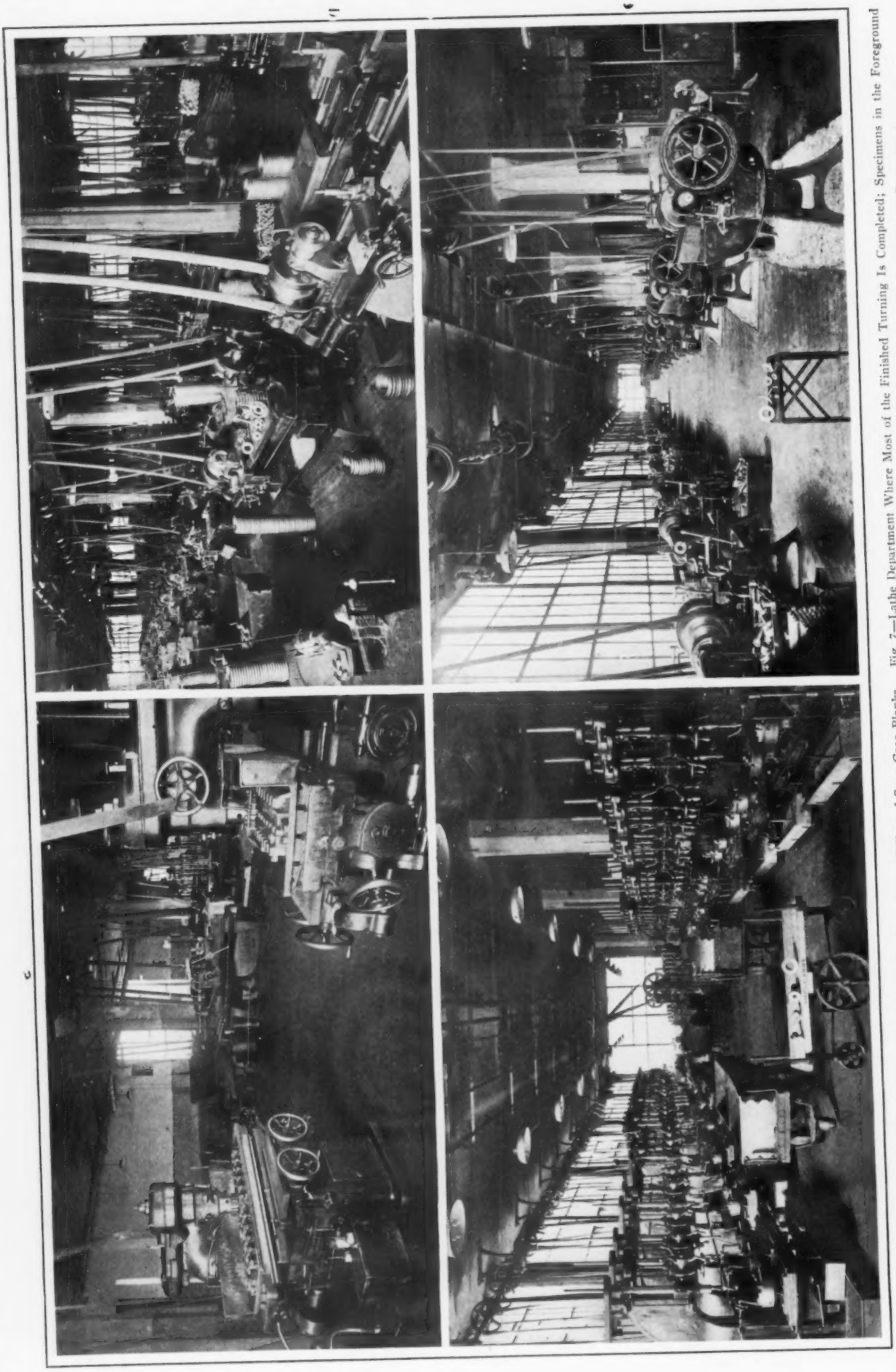


Fig. 6—Two Brown & Sharpe Vertical Spindle Milling Machines for Continuous Milling of Spur Gear Blanks

Fig. 7—Lathe Department Where Most of the Finished Turning Is Completed; Specimens in the Foreground

Fig. 8—The General High-speed Drilling and Boring Department

Fig. 9—View of the Screw Machine and Turret Lathe Department

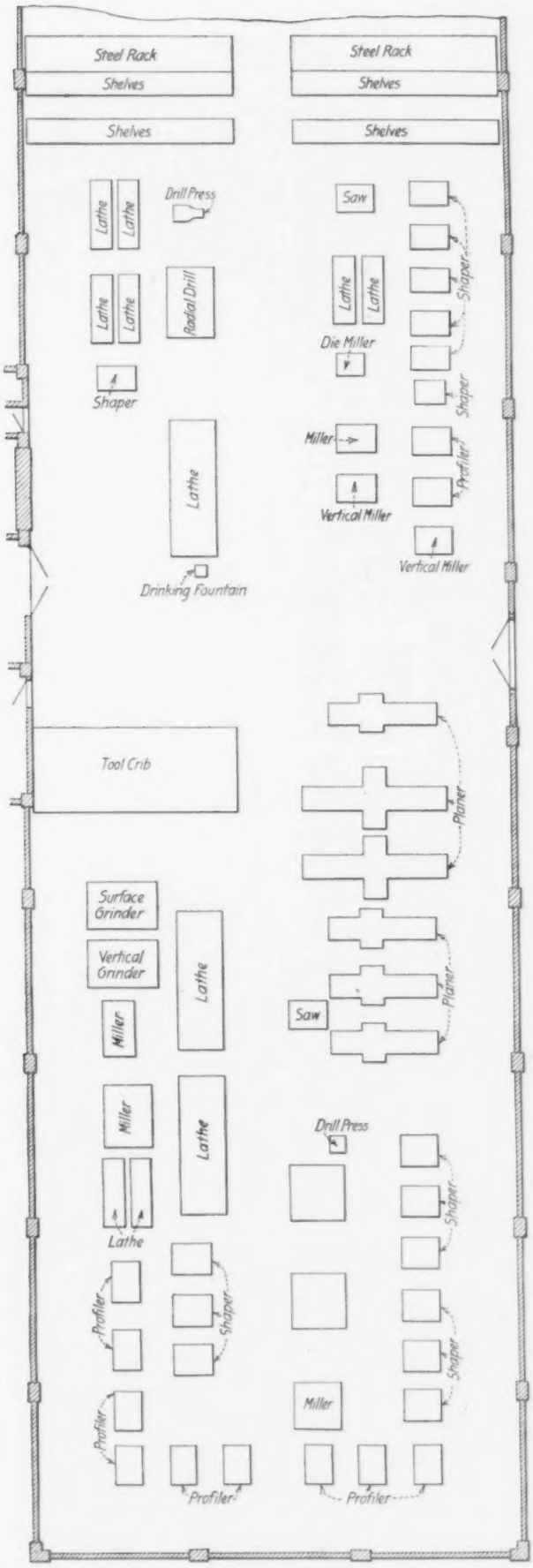


Fig. 5—Floor Plan Showing the Arrangement of Machine Tools in the Die Shop

companying engravings. The location of these various machine groups is indicated by the notations on the general layout of the machine shop in Fig. 5. From this layout the general sequence of operations through the shop may be traced. That this sequence is coincident with a general movement of material upward from the first floor to the fourth is apparent from the location of the receiving room on the first floor and the assembly department and finished stock room on the fourth floor. On the first floor the initial drilling and turning of transmission and clutch parts, steering post brackets and forged gear blanks is followed on the second floor by the lathe work in finishing these pieces. The small spur and bevel gear blanks that are turned up from bar stock are also produced on this floor on automatic machines, so that all the gear blanks are then ready for the tooth-cutting and forming operations on the third floor. Where a ground finish is required the high-speed and turret-lathe work completed on the second floor proceeds to the grinding department on the third floor. The essential machining operations are completed there and the gears, shafts and other parts that are to be hardened go to the heat treatment department to be returned subsequently to the fourth floor for assembly. The brass work which consists largely of turning up collars and bushings adjoins the assembly floor and the fitting and driving of these brasses immediately precedes the assembly.

On the Davis turret lathes and Potter & Johnson automatic machines mentioned and also on the group of eight Hartness two-spindle flat-turret lathes illustrated in Fig. 3 various roughing cuts are taken on such clutch and transmission parts as are shown placed on the small table in the foreground. It has been found with reference to machining such pieces on the ordinary engine or high speed lathe or on an automatic machine, that a happy medium may exist between the "one piece at a time" operation of the lathe and the complicated setting up requirements of the automatic machine, which halfway ground is best represented by equipment of the type illustrated in the above group. This illustration also shows conspicuously the advantageous interior arrangement afforded by the concrete construction used in this building. As will be noted, the shaft hangers are hung directly from bolts anchored in the concrete flooring above. An interesting safety device can also be seen in this view mounted on the face of the second column within easy reach. It consists of a push button, which controls the motor driving that department. Below the button is a large placard indicating that by means of this button a certain main shaft can be stopped at once, in an emergency. These push buttons are conveniently located at various places in the shop for the several drive groups.

The general drilling department for the boring of steering gear brackets, gear blanks and such parts as are shown on the truck in the foreground is illustrated in Fig. 8. This group of machines includes 22 Foote, Burt & Co. high speed heavy duty drills in three-spindle and two-spindle arrangement, also 12 Baker Bros. heavy-duty drills arranged in multiples of three. Where the piece requires consecutive operations either of drilling or reaming the work is passed from one drill to the next. This illustration also shows the admirable fitness of the tool arrangement and shop construction. The prominence with which the transfer truck so generally used in this plant is displayed in this illustration calls attention to the particular merits of its design in the convenient handling of material. The arrangement of the wheels is such as to give complete stability under any load, at the same time permitting the truck to be turned in any direction and in a small space with a minimum effort. For long pieces the truck without the box or for small parts with it is equally convenient.

The general lathe department which occupies the greater portion of the entire second floor of one wing of the machine shop is illustrated in Fig. 7. In this department the finished turning of differential gear-blank and push-ring forgings and the several parts shown in the foreground of this view is completed. The equipment includes about 60 Le Blond 17-in. heavy-duty automobile lathes and 35 Reed high-speed lathes. In addition to the lathe work on this floor a group of 27 upright and sensitive drilling machines are installed for the associated lighter drilling operations. These drills are of various types including those manufactured by the Barnes Drill Company, W. F. & John Barnes Company and the Rockford Drilling Machine Company.

The group of 16 Cleveland automatic screw machines and 21 Warner & Swasey Company turret lathes shown in Fig. 9 is located in the north end of the machine shop and is duplicated by a similar battery of machines also on the second floor in the east wing of the building and including

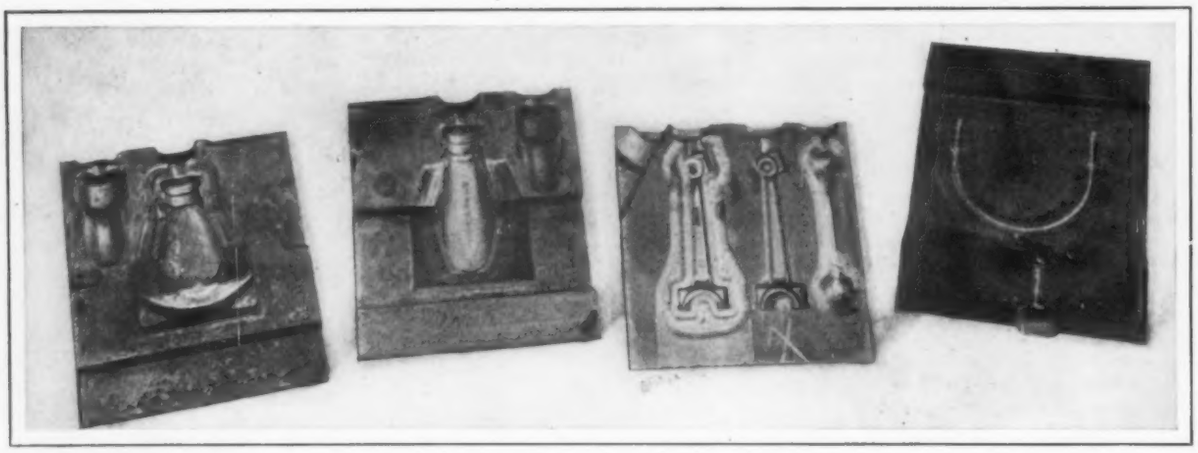


Fig. 10—Top and Bottom Dieblocks for the Crank-case Support; One of the Dieblocks for the Connecting Rod, Showing the Three Operations Completed on One Die, and the Finishing Die for the Lamp Bracket

37 Warner & Swasey turret lathes and 29 Cleveland new model automatic machines. On these last the gear blanks for the small steering-gear pinions are turned from bar stock as well as the usual cap screws, studs and pins. The turrets are equipped for both chucking and bar work of which examples are shown in the foreground of Fig. 9. An additional group of ten Warner & Swasey lathes, adjacent to the machines mentioned, is not shown in the illustration. In this section of the shop are located also the two No. 5 Brown & Sharpe vertical spindle milling machines shown in Fig. 6. These tools are rigged up for the continuous milling of blanks for the transmission spur gears, the manner in which the blanks are mounted being indicated from the illustrations. The cutter head is of a diameter large enough to sweep both rows of blanks simultaneously. The circumference of the blanks is subsequently finished on the lathes, a view in which department is shown in Fig. 7.

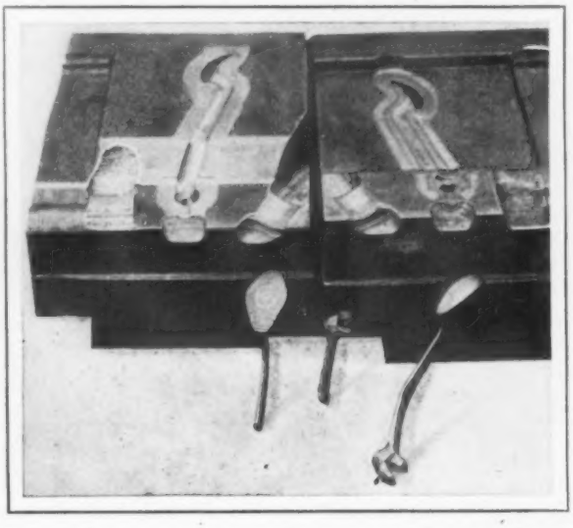


Fig. 11—Top and Bottom Die Block for Forging the Foot Pedals, Together with the Model Showing the Three Operations in the Completion of the Piece

The grinding department on the third floor includes 25 Norton, 14 Brown & Sharpe and 7 Landis grinding machines and three Pratt & Whitney and five Walker vertical spindle disk grinding machines and 10 Heald internal grinding machines. With the exception of the last all are wet grinding operations.

The equipment of the gear cutting floor and the arrangement is typical of the automobile industry. It includes a miscellaneous group of five Pratt & Whitney open-side multiple-cutter milling machines for machining square ends on the rear axle shafts, ten Whitney Mfg. Company's hand feed milling machines for machining slots and keyways, and 15 Brown & Sharpe plain milling machines for rough milling of small spur and bevel gears from the blanks machined on the automatic machines and for notching spark levers and other small work. Ten heavy-

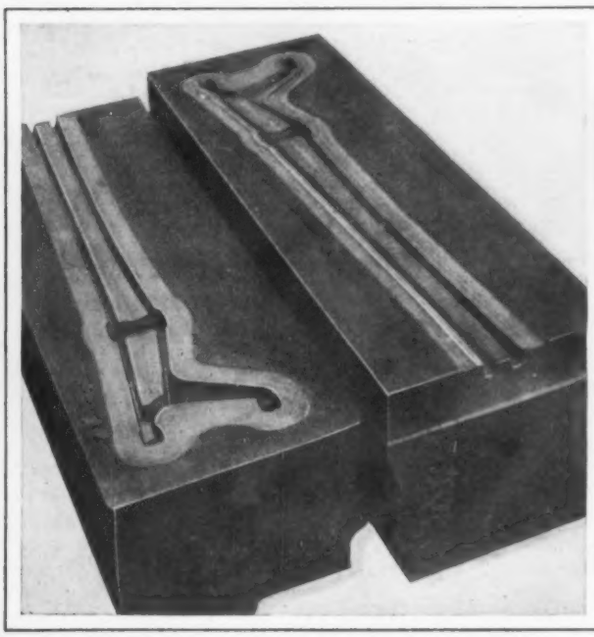


Fig. 12—Top and Bottom Dieblocks for the Front Axle, Forged One End at a Time. The Illustration Shows the Centers in the End of the Dieblock by Which It Is Handled

Fig. 13—The Bottom Crankshaft Dieblock Taken with the Die Mounted in the Hammer and Showing the Breaking Down Die at the Left and the Finishing Die at the Right.

duty Brown & Sharpe milling machines are rigged for gashing out the differential bevel gear blanks which are mounted in a bilateral jig accommodating four to six blanks. The machines have accordingly two or three cutters milling the blanks on one side while the work is being changed on the other side.

The gear forming machines for the finished generation of the teeth consist of a group of 50 Brown & Sharpe and 3 Flather automatic gear cutters, 47 Gleason gear generating machines and four Hugo Bilgram gear formers. The transmission spur gears are milled from the blanks, ten at a time, one operator handling a number of machines, while the bevel gears are finished on the Gleason machines.

On the fourth floor of the machine shop a second grinding department is installed for a final finish following heat treatment, and for grinding and buffing the handwheel spiders which with the steering posts are then enameled prior to the general assembling of the steering gear. The brass turning is done on a double row of small lathes and consists largely of finishing brass bushings for the steering post gears, the journal bushings for the main drive and the differential bearings. These are turned on arbors, the arbor presses being mounted on the lathe bed within reach of the operator.

Immediately adjoining the lathes are five Toledo Machine & Tool Company power presses for driving the bushings into the various parts with which they are associated. The general assembling of steering posts, transmissions and clutch occupies the greater portion of the west wing of the fourth floor. It is all bench work. The finished parts from the third floor and from the grinding, enameling and bushing departments on the fourth floor pass through the hands of a group of inspectors at the north end and move through the several stages of assembling to the finished stock room at the south end.

Fig. 14—General View of the Drop Forge Hammer Shop, Showing the Relative Positions of Furnaces, Steam-Hammers and Motor-Driven Trimming Presses. The Wide Center Aisle Is Spanned by a 15-Ton Crane

The forge shop presents some of the most interesting phases of the plant's manufacturing processes. The building is 400 feet long and 70 feet wide. A general view of the heating furnaces, forging hammers and trimming presses and their arrangement is shown in Fig. 14. Doors from the open courts on either side of the forge shop afford access to each pair of furnaces which are arranged along each side wall, while the wide brick-paved center aisle between the two rows of hammers avoids congestion in distributing the forgings from within the shop. The center span of the shop is traversed by a 15-ton Northern crane. The equipment after the removal of the heat treatment furnaces into the new building will include four 5000-lb. hammers, five 3000-lb., six 2000-lb., thirteen 1500-lb., eleven 1000-lb. and six 400-lb. double-frame steam hammers, all of the Erie Foundry Company manufacture. The power press equipment for hot trimming will include 19 Bliss and 21 Toledo trimming presses, all gear-driven from individual motors, the heavier machines being equipped with side punch. The heating furnaces, of which there are about 50, are oil burning. Fuel oil conditions have already brought about the changing over to gas burning furnaces in some of the plants at Detroit and the action seems likely to become general, involving this installation with the others.

The forgings made in this plant include front axles, crank shafts, connecting rods, foot pedals, lamp brackets, differential bevel gear blanks, transmission spur gear blanks, crank-case supports and clutch push rings. The crank shaft forging is made from 1 13/16-in. round bar stock, forged on a single die, Fig. 13, and is broken down and roughed out on a 3000-lb. hammer, and is trimmed and given a finishing strike with one heating. One end is then reheated and the flange upset in an Acme heading machine. The front axle, the die for which is shown in Fig. 12, is made from 1⅜-in. round bar stock. It is first heated and the ends consecutively upset in one of the heading machines to rough form the end bearings. It is then reheated, one end at a time, roughed out and finished on a 5000-lb. hammer. The making of a foot pedal involves three operations which are illustrated by the three pieces shown in Fig. 11. These consist of heating and rough forming the foot end, heating and forming the shaft end and a finishing strike to flatten the foot plate and give it a tread imprint, leaving a fin to be removed in a cold trimming press.

The forming of the lamp brackets is one of the most difficult of the forging operations. A ⅞-in. round bar is flattened on a roughing die, the center portion being forged to a thin web. This web is trimmed out on one die in the press, the piece is then split at one end on the side punch of the press and under the hammer is given an initial spread. After heating again the arms are given the final spread, the piece being placed vertically in a male and female die mounted in a power press so that the forming of the curved arms partakes of the action of a drawing press. The bracket is then finished under a 2000-lb. hammer in the die shown in Fig. 10.

The blacksmith shop is a recent addition to the plant and conforms to the uniform length of the plant buildings,

Fig. 15—The Blacksmith Shop, the Forging Floor on One Side and the Heading Machines on the Opposite Side

is 60 ft. wide and of steel framework with a monitor roof of the design indicated in the general cross-section. Like the other buildings the department is fitted with Fenestra sash with wire glass lights and is artificially lighted with tungsten cluster lamps. The general character of the building is apparent from the interior, Fig. 15.

An interesting suggestion is offered with reference to the durability of tungsten filaments in that the lighting clusters in this shop are hung from the crane runway. While from the standpoint of long life of the lamp this arrangement is obviously not the most desirable, it is in significant contrast to some former opinions as to the necessity of avoiding vibration in order to obtain satisfactory service. The manner in which the runway for the 10-ton Northern Engineering crane which spans the central 40 ft. of the building is hung from the crane trusses and braced may also be noted.

The floor of the building is of concrete except for that portion used for general blacksmithing which is a filled cinder floor. For the blacksmithing three Erie single-frame hammers are installed and the forges are open fired without hoods. On the opposite side of the shop are the seven Acme Machinery Company heading machines, including 2-in., 2½-in., 3-in., 3½-in., 4½-in. and 5-in. sizes. The work handled on these machines includes the upsetting of crank shafts and front axles, steering gear collars

Fig. 16—General View of the Sandblast and Grinding Room for the Cleaning of Forgings

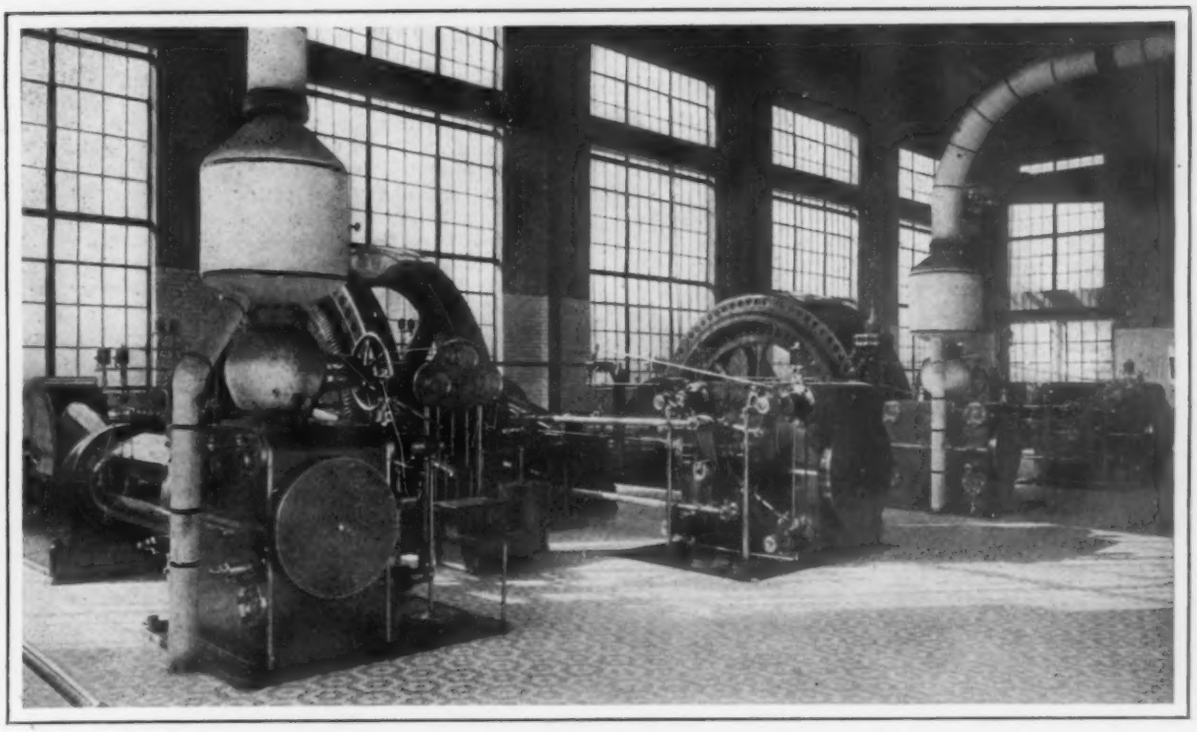


Fig. 17—A View of the Power Generating Apparatus and the Immaculate Interior of the Engine Room

and gear blanks. Various specimens of this work are in view in the illustration as well as the manner of handling the work in the machines with the light jib cranes mounted on the machine beds. The heating furnaces are placed at the side of each machine.

The air plant for the forge and blacksmith shops and the heat treatment furnaces and quenching baths is located in the north end of this building. Three General Electric Company motor-driven direct-connected centrifugal air blowers operating at 3450 r.p.m. supply air at 2 lb. pressure. This blast is used for the heat treatment furnaces and for cooling the quenching baths through which air is blown continuously. For the sandblast and for air jets in the forge shop, air at 30 lb. pressure is supplied from two Bury Compressor Company motor-driven straight line compressors with 16 x 12-in. cylinders. The air mains are laid in the floor. An oil circulating system for distributing fuel oil to the furnaces and installed by the National Supply Company, Chicago, has its distributing pumps located in this group. For supplying lubricating oil to the various machines in the shop Bowser portable oil buggies are used.

At the south end of the blacksmith shop the forgings are tested for hardness. At this end a group of presses is also installed for cold trimming. It is the intention to confine the press work in the forge shop to hot trimming and to reserve the cold trimming for the group of Toledo Machine & Tool Company presses in this building. This ar-

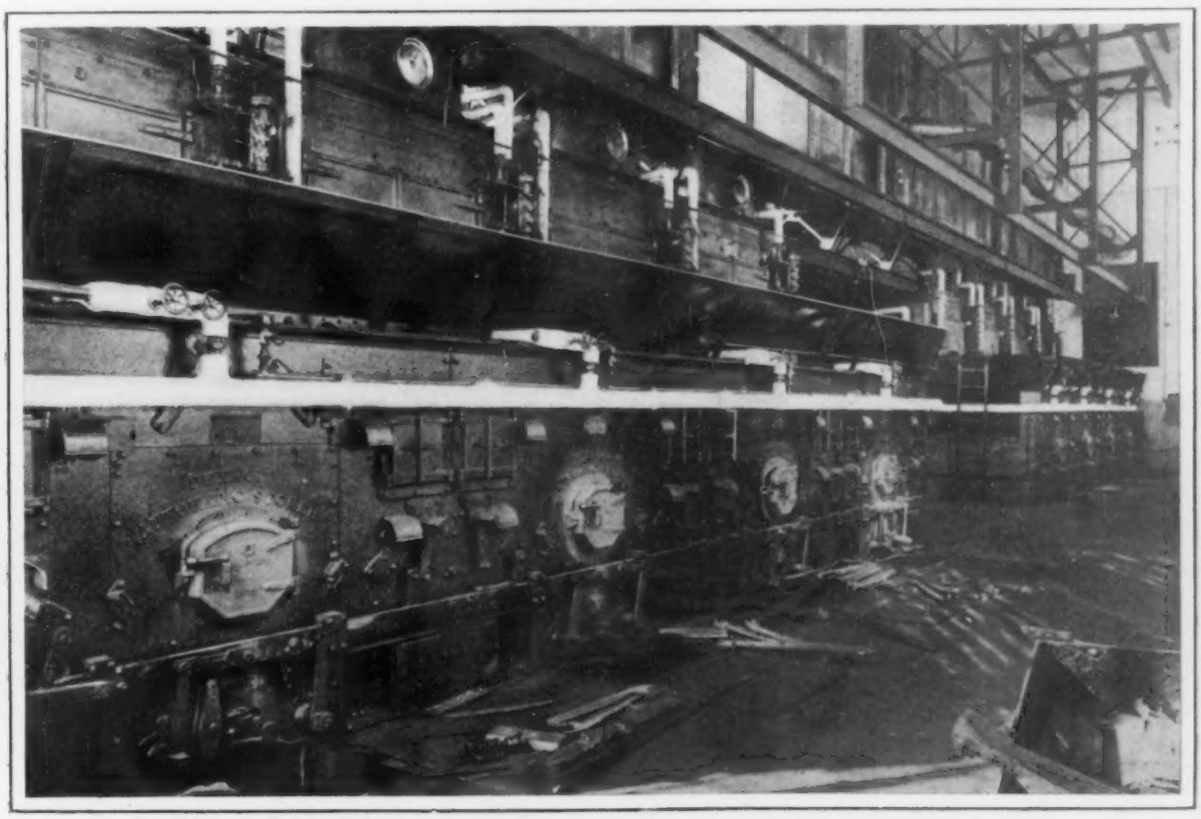


Fig. 18—Arrangement of the Boiler Front, View Taken When the Boilers Were Down

rangement brings the forgings directly to the sandblasting and tumbling department for cleaning. This equipment is located in the wing connecting the south ends of the forge and blacksmith shops and consists of the ordinary types of rumblers and abrasive grinding machines and four sandblast equipments of the type manufactured by the Tilghman-Brokksbank Sand Blast Company, Philadelphia. A view of this section of the building is shown in Fig. 16.

Pending the completion of the heat treatment building shown in the general plan and elevation of the plant, the heat treating furnaces are located in the south end of the forge shop. In the present plant only those forgings which are finished in the machine shop are annealed or heat treated. These include the rear axles, main drive shafts, planetary gears, driving pinions and other gears and drive discs. The treatment of the Ford crank shafts, cam shafts, and front axles is done at its own plant, as is the carbonizing of the gears also. The arrangement and type of furnace used are shown in the general view, Fig. 1. There are 18 oil-burning hearth furnaces in two rows in the center of the floor and eight cyanide furnaces at the side where the windows provide the maximum ventilation. From each of the furnaces, the cyanide fumes are carried up through a stack to an overhead main and passed through a water trap in which the cyanide is collected. This solution is then evaporated in the large pans placed above two of the furnaces and a considerable portion of the somewhat expensive cyanide is recovered.

An overhead trolley is hung in front of the furnaces for handling the hot steel out of the heat into the quenching bath. The pieces are laid on a rack in the bath so that when cooled they can be brought to the surface and easily removed. The thin drive discs following the heat treatment are cooled in water-jacketed presses to prevent warping and in 24 hr. 12,000 plates are so cooled in one press. A portable rack is used for charging shafts into the furnace hearth in an orderly arrangement, thereby effecting an economy of time and furnace space as compared with the former method of charging by hand. By means of this device 125 shafts are placed in the furnace at one operation and in such a manner as to make possible a complete heating in two and one-half hours.

Power is generated from a steam plant consisting of eight 150-hp., 72 x 18-in. Wickes horizontal return-tubular boilers, arranged as shown in Fig. 18 in two sets of four with overhead breeching and center stack. The boilers are equipped with Detroit automatic stokers and Foster superheaters. The coal handling arrangement is the Northern Engineering monorail grab with capacity for handling three carloads daily to the bunker. From the coal room a self-contained motor-driven bottom-dump hopper operates along an overhead track above the stoker hoppers, transferring the fuel to the boilers. The ashes are drawn out and dropped into a tunnel along the boiler front, from which they are elevated by induced draft through a pipe to an overhead receiver outside of the building, from which they can be loaded through a bootleg into a car.

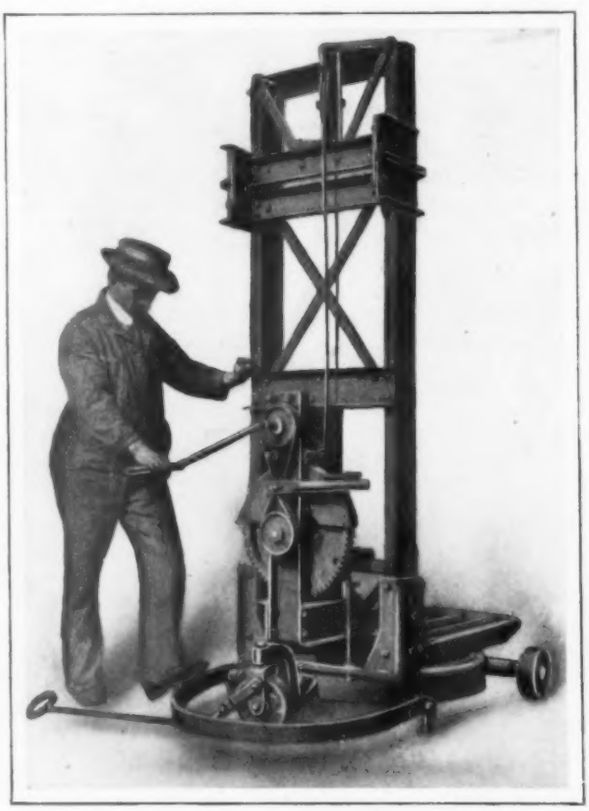
The converting units, as shown in Fig. 17, are two Allis-Chalmers cross-compound Corliss engines direct-connected to 480-volt three-phase 60-cycle generators. A 1000-kw. low-pressure steam turbine is now being installed to operate on the exhaust steam from the forge shop. For direct current the plant includes an Allis-Chalmers 120-hp. motor generator set delivering current at 120 volts and also a Ball high speed engine generator set delivering the same voltage. With the exception of the trimming presses, upsetting machines and turbo blowers which are driven by individual motors, the drive throughout the shop is arranged on the group plan with the motors mounted overhead.

The scheme of the works was planned and the buildings designed by Smith, Hinchman & Grylls, Detroit.

India's First Shipment of Steel.—The Indian (official) Trade Journal, Calcutta, publishes the following: "The Tata Iron & Steel Company, Ltd., makes its first shipment of steel goods this week (mid-November). It is understood the consignment goes to Japan and amounts to 500 tons, worth about half a lakh." The Daily Consular and Trade Reports, from which this is taken, states that the value in United States money is $16,221, which would be $32 per ton.

Floor Lock for Portable Elevators

The New York Revolving Portable Elevator Company, Jersey City, N. J., has equipped its revolvators with a new type of floor lock which acts to make a portable tiering machine rigid on the floor. As will be seen in the illustration, it consists of a steel bar of a semi-circular form having at each end a lug which forms two feet upon which the machine rests when it is in use. When the steel bar is raised the weight of the machine rests on the three wheels, and, as the machine is pulled around, the feet cannot come in contact with the floor, no matter how uneven it may be. When the machine is being located for work the operator pushes down the bar with his foot and the action is to lift the front of the machine slightly, so that the swivel wheel is clear of the floor. The revolvator is then resting upon two feet and the two rear wheels, thus securing a rigid foundation with four widely separated points of support and so large a base area that the center of gravity of the load is always within it.



The Revolvator, with Floor-Lock in Position

When loads of excessive bulk are to be handled the machine is supplied with a longer rear axle and with a greater distance between the feet of the floor lock, so that it is absolutely impossible to tip over. The device does not interfere with the revolving feature. It has been made a standard part of the company's machines, electric, hydraulic and pneumatic.

The Allen Engineering Company, manufacturer of transmission and conveying machinery, Memphis, Tenn., was placed in the hands of receivers December 24, on application of a majority of the stockholders. Thomas H. Allen, former president of the company, and Lamar Heiskell, clerk of the Chancery Court, were appointed temporary receivers. The statement is made that the company is amply solvent, having a surplus of about $40,000 above all liabilities. It is hoped that the receivership will merely be temporary. All costs of the receivership are to be held down and everything will be done to conserve the assets of the company.

Since 1880 the total value of the mineral production of Alaska has been $207,000,000, of which over 90 per cent., or $195,619,776, has been in gold, according to A. H. Brooks of the United States Geological Survey.

The Easier Reading of Drawings

Simpler and More Lucid Designations of Parts, Materials and Dimensions to Procure Greater Efficiency and Accuracy

BY ROBERT I. CLEGG

Curiously enough the tools and the practices of the mechanical draftsman show a marked degree of what may for lack of a better and perhaps a stronger word be called conservatism. Just now we need only comment upon the practice as exploited by a few recent examples that have come my way.

First, why is it necessary to draw carefully to scale all the parts of a common type of screw—the square or hexagon head with its chamfering, and the shank with its thread—and then repeat the message by a laboriously neat lettering of all the details? Would not the latter half of this work have been in every way sufficient for the purpose? A light line and the convenient arrow at its end connecting a brief description with the center line indicating where the aforesaid screw is to be applied, would be about all that could be required in sending drawings from one shop to another.

If the drawing is to be used in any department of the plant where it is made, then another plan and a somewhat simpler one is permissible. The several standard tables of the bolts and screws that are in general use in the plant can in each case be given a symbol designating them respectively in any convenient style. A combination of the figures and the arbitrary symbol indicating the dimensions and the style of bolt or screw fastening, would at once place the identity of the item beyond dispute. Such a custom would do away with a lot of drawing.

Talking of the "arrow" reminds me of a plant where the barbs of the arrow-head are expected to be precisely of an angle of 45 degrees with the main stem. To draw the two halves of the arrow-head and make them equal and do the job rapidly, requires quite a little practice, if the result is to look good. The arrow is sufficiently unmistakable if there is only one barb or hook to the arrow-head. The end of a dimension line, or of any other line for that matter, calling for an arrow-head, would be just as clear to the reader of the drawing if only one and not two of the hooks terminated the line as an eye-catching pointer.

Accentuated Dimensions

One or more dimensions in every drawing are in a class by themselves. For one reason or another they are more important than the rest, or it may be that these are to be first considered in making the initial cuts or layout. They are the landmarks to be strictly observed, as upon them all the other operations are imposed and without that firm foundation the workman will find slippery footing with all future transfering of his figures.

These special starting points need to be called promptly to the notice of the user of the drawing; otherwise time will be lost and there will also be the danger of things going wrong. It has been proposed that these important items be specially designated in some readily seen manner, in order that they may the better be brought at once to the attention of the workman. Some study on his part is necessary before he starts work. A dependable workman makes sure he is right before he goes ahead—so much at least he owes to his reputation. He must become familiar with what he is to do. The unnecessary length of time he is required to puzzle and to ruminate over the drawing costs the employer as much in useless time expended as though the operation of a machine were deliberately delayed by the cutting of a belt. The shorter the preliminaries, the better for everybody. If the workman's eye can at once catch from the message of the drawing the principal things that he ought to keep in mind during the several operations on the parts shown, then we have saved considerable time at the beginning and the work may proceed to the general satisfaction of all concerned.

With this end in view it has been proposed by Mr. Taylor that a plain cross be prominently placed in some conspicuous blank space of the drawing and that from this cross light lines are to be drawn to the leading dimensions, or even the descriptive lettering that should first be noted in carrying out the instructions laid down by the draftsman. But there is a matter of some weight to be considered here. It may not be practicable to draw these lines where we want them unless we, in crossing other lines, conflict with them, or in some similar manner complicate the appearance of the drawing. The same end would be gained without danger of misleading interference if we adopt the simple expedient of drawing a circle around the important dimensions. When it happens that we wish to call special attention to a line of lettering of any kind we can stretch the circle into an oval or a square drawn around the letters, the enclosure meaning exactly the same thing as the circle and in its turn being quite as prominent as the cross could be.

Plain Wording vs. Section Symbols

Standard sections have been proposed from time to time to represent the various materials in shop use. Much ingenuity has been bestowed on these symbolic schemes. A drawing now at hand employs two labored methods of illustrating sections of wood and of stone. Would it not have been as well to use the ordinary 45-degree diagonal section line with the words "wood" or "stone" as required in each case? The symbolism would have to be explained in the case of the section representing stone. And the longitudinal section of the wood beam is not any too distinctive. If an explanation is to be made to the workman, verbally or by a separate sheet than the drawing, then why not adopt the sure and simple scheme of lettering? Mark Twain improved a poor drawing by writing on it that one crude outline was a horse no matter what it seemed to be.

Luckily the distinguishing words are very brief in most instances. No one can grumble fairly at writing them on the drawing. Steel, wood, lead, brass, brick, are brevity itself. The abbreviations for cast iron, wrought iron, and malleable iron are easily understood and have become standardized by common usage. The names of other materials, such as vulcanite, for example, may be spelled out for general use, though in a shop frequently employing this substance an extemporized abbreviation would be readily recognized. That the sheets should be standardized as to size for convenient storage, and that the borders on bond paper, and much of the lettering on the edges of sheets be printed on a press, are points commonly accepted and need not be discussed.

The marks for feet and inches are sometimes so small that in blueprinting they are lost to sight. One of any pair of these tiny indicators may disappear and leave the remaining quantity 12 times larger for the subtraction. Would there not be a distinct gain if these tiny marks were discarded? Could the change be made with safety? Suppose that we decide that any fraction or figure standing alone represents so many inches, and let us further suppose that in the case of two figures at the respective ends of a short dash drawn horizontally the figure at the left indicates the number of feet, while the one at the right means the number of inches or fraction thereof. For instance, let us take the case of twelve feet, eleven and a half inches. This quantity may be represented as twelve feet, eleven and one-half inches, or as 12′—11½″, but I doubt very much if either of these methods is more distinctive and informing than 12—11½.

These suggestions in the direction of simplicity may not greatly impress the expert who from long practice has formed habits not easily amended in minor particulars. But every winter there is a renewal of classes of instruction using systems crystallized by countless repetitions, and at this time, therefore, one may, if ever, venture a few criticisms of the prevailing practice.

Progress in the Metallurgy of Iron and Steel

A Résumé of the Noteworthy Developments of 1912 in Works Practice and in the Experiments of Well-Known Laboratory Investigators

BY BRADLEY STOUGHTON

It is very difficult to write much upon the progress in iron and steel in any year for readers of *The Iron Age*, because the editors of this publication allow little to escape their notice, either of what happens in the works or appears in printed form. The past year has been an "off year" as far as innovations in operating practice are concerned; but it has been unusually active in bringing out scientific investigations and researches. Among some important events are those set out in the annexed summary.

Metallography and Magnetism

The "Report on the Progress of Metallography During 1909, 1910 and 1911," by E. Heyn[1], is of more than usual practical interest and value. His resumé of the data on gaseous and solid inclosures in iron and steel, on cementation of steel, and on the iron-carbon equilibrium diagram forms in each case an important introduction to the work carried on during 1912. Continuing the report of Heyn on the iron-carbon diagram, the researches of Wittorff[2] on alloys of iron and carbon containing more than 4 per cent. of carbon have greatly clarified our notions of the constitution of high-carbon cast iron, of the annealing process in malleable cast iron manufacture, and of the much-discussed question of the different carbides of iron. Wittorff's results have explained the observation of Osmond, that iron rich in carbon becomes solid when heated to a very high temperature, on the basis of the formation of an endothermic carbide, Fe_3C. The results also tend to show that primary graphite may separate even when the iron-cementite equilibrium prevails. They prove the birth at high temperatures of several carbides of iron; for example: FeC_2, Fe_3C, FeC, Fe_4C, and they help to elucidate several related points that have long been in controversy.

In studying the relation between the critical points and magnetic variations, investigators in the laboratory of the Creusot Works[3] have shown that the disappearance of magnetism reveals not only A_2, but also very clearly A_1; that at 200 deg. C there is a decrease of magnetic permeability corresponding with disappearance of magnetism from iron carbide; that steel containing much gas has abnormal hysteresis and coercive force, with a critical temperature in these respects at about 250 deg. C; and that quenched steel has a critical point in permeability and dilation near 300 deg. C. In studying the allotropy of iron, Benedicks[4] argues that the point A_2 is not caused by an allotropic change, but that beta iron is really alpha iron wtih varying proportions of gamma iron in solution, and he further urges that iron has another allotropic transformation range between 100 and 400 deg. C. Waggoner[5] tells us that the relation between the hysteresis loss, intensity of magnetization, maximum susceptibility and the carbon content in a series of unhardened steels, might have been predicted from the Ewing theory of magnetism and a knowledge of the physical characteristics of the microscopic constituents of such steels; and Gumlich[6] says that dissolved carbon increases proportionately the coercive force and decreases remanence, while silicon improves the magnetic properties, apparently by transferring dissolved carbon into the form of carbide or graphite. The question of the magnetism of iron, and of ferro-magnetism in general, was fully discussed at the 63d meeting of the Faraday Society, and important researches have been reported by Hilbert, Mathesius, Colver-Glauert[4], [6], [7], and Weiss[1]. The three former investigators have proved that alpha iron is not the only magnetic modification; that quenching at 1200 deg. C. increases the magnetizability of nickel steel and manganese steel; that at temperatures above 1050 deg. compounds are formed which are magnetic at atmospheric temperatures; that an increase in magnetizability is obtained by annealing between 400 and 450 deg. C.; and that the 33 per cent. nickel steel has special properties. This is interesting in connection with the statement of Weiss[1] that Fe_2Ni (containing 34.5 per cent. nickel) is very important magnetically, and that Fe_2CO has 10 per cent. more saturation intensity than pure iron.

Case-Hardening and Cementation

The extensive researches of Giolitti* have been followed by a number of important discoveries in 1912, of which those published by Guillet and by Nead and Bourg are already familiar[9]. Sauveur and Reinhardt[8] propose an ingenious method of case-hardening alloy steels without quenching. It is known that some alloy steels are in the

*See Heyn[1], loc. cit.

Important Developments in Iron and Steel Metallurgy in 1912

Several new iron ore deposits have been described; also novelties in thin-lined furnaces and in means of supporti ıg blast furnaces.

The duplex and electric steel processes have been extended in the United States.

There are a new open hearth raw material and a new open hearth fuel, also a new steel foundry converter and a new charcoal wrought iron process.

Several new methods have been described for avoiding pipes, segregation and blowholes in steel ingots.

Copper is being added to rail steel and pipe steel, and the manufacture of rails is being subjected to a radically new method of inspection.

Mayari pig iron has been described.

There is a new process for chilling cast iron and for testing charcoal pig iron; also a new process for brazing cast iron.

Our knowledge of the heat-treatment of steel, and of case-hardening, has been much increased, as well as our knowledge of gases and blowholes in steel.

We know more than we did a year ago about the relations of iron with sulphur and manganese, about the relations of iron with more than 4 per cent. of carbon, and about the magnetic properties of iron and other ferro-magnetic alloys.

Finally, the equilibrium diagram—that hyper-theoretical instrument—has shown itself to be of indispensable practical value in improving the quality of cast iron, as well as in the operating management of the blast furnace independent of the quality of the product.

martensitic condition at atmospheric temperatures, when high in carbon, and in the pearlitic condition when low in carbon. By manufacturing such steels low in carbon and then carbonizing them by cementation, the surface is made hard, because martensitic, without any quenching. Nolly and Veyret[3] have made a study of the gas disengaged by carbonizing materials used for cementation with the object of avoiding the explosions frequently experienced. They find the disengagement is most active from 300 to 700 deg. C., and advise heating up slowly to 700 deg. They also advise avoiding animal and vegetable carbonizing agents and using charcoal mixed with 30 to 50 per cent. of barium carbonate. The influence of hydrogen was shown to be more dangerous than nitrogen, and it was shown that it decarburizes iron at 800 to 900 deg. and makes it very brittle. They believe hydrogen to be the cause of much of the fragility, brittleness and coarse-grained cores in cemented steel.

A process said in France[8] to be new and to have been invented by Daebritz, consists of what is called "partial cementation," whereby those parts of an article at which it is desired that the carbon shall not penetrate are covered with a coating of copper, nickel, or other inert metal. Giolitti[7] declares that solid carbon will penetrate iron, but weakly; however, Charpy and Bonnerot[3] have repeated their experiments with yet greater care and confirm their previous observation, that carbon cannot penetrate iron at about 950 deg. C., provided all gases are excluded. They then inquire, Can carbon diffuse in the interior of iron without the aid of occluded gases? Lothrop[10] has published some valuable results on the effect of temperature, efficiency of different carbonizing materials, and cause of irregularities. Part of his work could have been expended more effectively if he had been familiar with the results of previous investigators, but much of it is new. Abbott[2] gives us some useful data on the best carbonizing materials and best carbonizing temperature to use for different articles, and Ammon[2] supplements these with a new method of determining depth of carbonization and efficiency of hardening by a combination of the Brinell and Shore instruments.

Defects in Ingots and Steel Castings

One of the most notable contributions of the microscope to the manufacture of steel, is the detection of solid enclosures, which Hibbard has dubbed "sonims." Oxides of iron, manganese, silicon, phosphorus, aluminum and calcium, sulphides of iron and manganese, all have had their evil influence in causing failures and breakages, without suspicion being attracted to them in the past. Some of these sonims occur in the tiniest of specks, but distributed in the form of a veil through the steel, so as often to cause a plane of weakness. Others occur as drops, or webs, having much the same effect as an unwelded blowhole. Packer and others[7] discussed this subject very fully; Mars[7] describes more in detail the means of detecting the occlusions; Becker[7] and Loebe have extended the researches of Friedrich, Treitsche and Tammann, Le Chatelier and Ziegler, by investigating the system Fe-FeS, while Roehl[11] has studied the system FeS-MnS, and discovered a new compound, $Fe_3Mn_2S_5$, which he thinks has been mistaken by Le Chatelier and others in steel for MnS. Since the new compound has a melting point of 1360 deg., as compared with 1620 deg. for MnS, it would appear that the former is more active in producing the well-known desulphurization occurring in hot metal mixers, since the MnS would be solid at the temperature of the iron in the mixer.

Cases and Blowholes in Iron and Steel

Austin[4] heated bars of cast iron, crucible steel, medium and mild open hearth steel and Bessemer steel in a closed tube by means of electricity until they melted. The evolved gases were collected, measured and analyzed. The maximum amount of gas was obtained from the crucible, the next from the mild steel, and the least from the cast iron. The bulk of the gas consisted in hydrogen and nitrogen, with CO and up to 5.6 per cent. of CO_2. It was interesting that the higher the carbon content of the steel the more gas it disengaged. The hydrogen and nitrogen (recorded together) was higher in the cast iron than in the steels. Charpy and Bonnerot[3] have studied the permeability of iron by hydrogen, and find that hydrogen acquires a special chemical activity in traversing iron. Sieverts[4,12] studied the solubility of hydrogen in copper, iron and nickel, and finds that, at their respective melting points, copper gives up 2 volumes, iron 7 volumes, and nickel 12 volumes. Andrew[4] states that hydrogen has no effect upon the critical changes of iron, but that nitrogen to the extent of 0.3 per cent. entirely suppresses the critical changes of pure iron; that steel containing 0.60 per cent. carbon and 0.25 per cent. nitrogen shows a marked lowering of Ar_1 and can be brought back to the normal state only by several weeks' heating in vacuo. Steel, splashing upon the sides of the ingot molds during pouring, solidifies into small globules which often cause surface blowholes. These splashes are hollow, sometimes with very thin walls. In order to prevent them, the Obouchoff Works, according to Troubine[4,5], pours the steel through a truncated sheet iron cone which is always suspended just above the top of the metal in the mold, and is raised as the pouring progresses. The splashes adhere to the cone, which is encrusted with them. Since this practice has been in vogue, the ingots have been free from surface blowholes.

Stead[4] says that internal blowholes do become perfectly welded up during the usual heating and rolling, provided there is an absence of sulphide segregations, and that surface blowholes, which become oxidized inside, do become more or less completely welded up, provided the temperature is high enough, and provided they are maintained at that temperature long enough after the holes have become closed to admit the carbon in the adjacent steel to reduce the oxide scale.

Producing Sound Ingots

An extraordinary amount of attention was devoted during 1912 to the subject of preventing blowholes, pipes and segregation in ingots. Hadfield[4] describes his process of preventing piping, as follows: Heating the fluid steel in the upper part of the ingot by the combustion of charcoal by means of a blast of air, the charcoal being supported on top of the metal with a thin layer of slag between. Goldschmidt[4] describes a new method of using his thermit for preventing piping. Instead of using the thermit cartridge to melt the upper part of the ingot after the lower part had already solidified, the cartridge is plunged to the bottom of the ingot before it has begun to solidify. The consequent reaction causes a violent boiling of the steel, which disengages the gas, the level of the metal consequently sinks, and then fresh metal is poured in the top. The process has already been adopted for large ingots, especially at steel works in Europe. From ½ lb. to 1½ lb. of thermit is used per ton of steel ingot. Talbot's method for preventing blowholes and pipes[13] consists in reducing the size of the ingots by rolling in the ordinary blooming mill while the inside is still liquid. This process has already been described with some detail in *The Iron Age*.

Heat Treatment of Steel

Our knowledge of the crystallization of iron alloys with less than 2 per cent. of carbon has been extended by researches of Belaiew[14], and especially has he developed the importance of examining by the naked eye the so-called magrostructure. Since the publication of his researches, the visibility of "Widmanstaetten structure" at a magnification of not greater than 50 diameters, is sufficient cause for the rejection of the steel by the Russian artillery. Belaiew states[9] (September) that magrostructure exhibits the stable form of the structure of steel, while microstructure reveals chiefly the effect of the latest heat treatment or mechanical treatment. He finds[14] that the primary crystallization of steel is in the form of dendrites, each dendrite being made up of octahedrons. These dendrites can be seen with the naked eye after prolonged attack with acids. In the austenite region of the iron-carbon equilibrium diagram there occurs a granulation of the steel, which can be made visible by attack with hydrochloric acid at high temperatures. This granulation as well as the primary crystallization, affects the secondary crystallization, and, with rapid secondary crystallization, we get the "Widmanstaetten structure." Portevin and Bernard[2] investigated the relation between the mechanical properties of steel and the "Widmanstaetten structure"; they found that this harmful structure is produced by too long sojourn in the zone of granulation (the zone where austenite is stable), and by too rapid cooling when leaving this zone, and that therefore it may be a result of forging if this condition

is not considered. They also found that the Widmanstaetten structure may be destroyed by quenching at 850 deg. C., followed by reheating to 700 deg. C. Steinberg[15] and Oberhoffer[7 9] discuss at length the refining of structure of steel forgings and steel castings, respectively.

Some interesting discoveries in the heat treatment of steel castings have recently been made in the United States and the publication of them is hoped for in the near future. Sauveur[1], in studying the growth of ferrite below Ar_1, has discovered that there is a critical strain producing an abnormal growth if the iron is heated thereafter. This will naturally be viewed with much interest by those using iron bracing rods for boilers and other furnaces. Sherry[6] also contributes some data on coarse crystallization of soft steels.

Iron Castings

There is a steadily increasing use of mechanical appliances in gray iron and malleable cast iron foundries[16], and it is worthy of note in this connection that the much-discussed question of mechanical charging of cupolas seems to come nearer and nearer a successful solution.[9] The use of permanent molds has been discussed[7] without bringing out anything especially novel, but a new method of producing chilled castings, by using water for chilling instead of metal pieces set in the sand, has been developed by the veteran foundryman Thomas D. West.[17] The regenerative open hearth furnace has long been used in malleable cast iron manufacture, replacing air furnaces, on account of greater control of temperature and chemical effect, saving of fuel and repairs to bottom. It is now being used for the same reasons to produce high-grade gray iron castings.[16] Bent's account of the improvement of cast iron by the use of a certain proportion of Mayari iron ore in furnace burdens, and Johnson's work on the improvement of charcoal cast iron are already familiar to readers of *The Iron Age*. An improvement in the brazing of cast iron is reported by Mascelon.[18] It consists in the use of an alloy having a copper base, which makes the brazing adhere better to the surface of the iron. The trade name of "ferrocementine" is given to this alloy. The making of cast iron reinforced concrete columns is recommended by von Emperger.[7] A cast iron column 14 cm. diameter and 3 m. long sustained a breaking load of 137 tons. When surrounded with concrete 29 cm. thick and allowed to stand for 61 days it gave breaking loads of 315, 307 and 342 tons. Schoettler[18] gives a very interesting series of tests of cast iron with different sections.

Copper in Steel

Steel for welded tubes has been made with small amounts of copper, in order to get the advantage of lower corrosion, but difficulty has been met with in the welding operation, and but little progress has been made in consequence, although the alloy seems to have value. Copper has also been used to the extent of 0.25 and 0.30 per cent. in rail steel, and the metal is now in the track undergoing test, for which great hopes are entertained by some persons.

Better Rail Steel

Constant experimenting is in progress to improve the quality of rail steel. A recent publication[16] of the rail failures on all of the Harriman lines for three years shows that the old 80 and 90-lb. sections of the A.S.C.E. break from two to three times as often in cold weather as in warm weather, whereas the new 90-lb. section of the American Railway Association not only shows a smaller proportion of failures at all times, but shows only a very few more failures in cold weather than in hot weather. There has recently been established a radical development in the inspection of steel rails, whereby a large body of inspectors representing the consumer watch and record every event in the manufacture of the rail from pig iron to finished product.[3] The records so obtained will be of inestimable value to both manufacturer and consumer when there is added to them the record made by the rails in service.

Progress in Welding

In the welding of skelp into tubes, to avoid heating the entire skelp to the welding temperature, trials are being made of a process of heating only the parts to be welded by means of the oxy-acetylene flame. The use of "flameless combustion," which has recently come into more prominent notice, has been suggested as a still cheaper method of accomplishing a like result. Stanton and Pannell[4] have tested 167 welded joints by tensile and fatigue tests, in order to determine the efficiency of welding. Their conclusion is that, in important work where the failure of any particular weld may involve serious damage, every welded joint should be subjected to a proof load. The welds made by the oxy-acetylene process were found by them much inferior to both the hand and the electric welding processes. A summary of their results follows:

	Average
Hand-welded iron, percentage of unwelded iron	89.3
Hand-welded steel, percentage of unwelded steel	81.6
Electrically-welded iron, percentage of unwelded iron	89.2
Electrically-welded steel, percentage of unwelded steel	93.4

Electric Furnaces

In the smelting of iron ore to produce pig iron, the furnaces at California[6 16] and Sweden continue to occupy the chief attention. The installations in Sweden are rapidly increasing and seem to be an assured commercial success.[2 8 6] The manufacture of ferrosilicon also seems to be taking on large proportions and at commercially practicable costs.[2 6] Lyon[6] has shown that electric pig iron is not only of high quality, but that it can be converted in open hearth furnaces at low cost. The electric melting of ferromanganese is also coming prominently into notice.[7 9] The total number of active furnaces for making steel is now over 70, most of these, of course, being in Europe. Two new electric foundry furnaces have been erected in the United States in 1912, and it is announced that the Bethlehem Steel Company is installing a Girod furnace for super-refining.

Novelties in Conversion Practice

Briquettes are being sold to open hearth plants in Europe under the name of "Swedish sponge." They contain 96.6 per cent. of iron, 1.4 per cent. of ore gangue and 1 per cent. of oxygen, and are made by converting iron ore with carbon-monoxide gas at temperatures below the fusing point of iron. When melted in open hearth furnaces, these briquettes are said to make a very good quality of steel. If the reducing gas were made from oil, this process would seem to have value for such localities as California, for instance. Tar is not a new open hearth fuel, but the importance now being attached to it is quite new, and, in view of the recent action in cutting off the supply of fuel oil in the East and Central West this fuel may find increasing usefulness. The duplex Bessemer-open-hearth process is being adopted at two additional large American steel works, and the mechanical puddling of iron on a large scale has been adopted at a large pipe works. Announcement is made[19] of a new process for producing direct metal in a cupola.

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Fig. 1—The New Plant of the Gilbert & Barker Mfg. Company, West Springfield, Mass.

Lessons of Gilbert & Barker Shops

Works Lay-Out at Springfield, Mass.—Acetylene Generator House Designed to Minimize Explosion Damage—Carbide Refuse Disposal Plant

BY JOHN NELSON.

The new plant of the Gilbert & Barker Mfg. Company, Springfield, Mass., affords an unusually fine example of the transitions in manufacturing conditions that come with the removal of a business from old buildings in a congested city neighborhood to a home possessing every advantage which tends toward economical and efficient production. The company has been successful since the establishment of the industry in 1865, and the growth of the business in recent years has been rapid, making necessary from time to time the extension of the old shops. But circumstances of environment made impossible the arrangement of increased facilities along present-day lines.

The new works are modern in every detail, in the design of the buildings and the provision for future growth, in the equipment, and in the system which pervades the management. The old shops had 20,000 sq. ft. of floor space. The loading platform alone at the new plant has nearly 4,000 sq. ft. and the total floor area of the buildings is close to 100,000 sq. ft. Within a short time over 500 men will be employed. Though order has not wholly emerged from the chaos of moving and occupation, decreased cost of production is apparent, as is proved by the cost records. The employees, many of whom have been with the company for years, are in better health and spirits, though in the beginning some of the older men found it rather difficult to adapt themselves to their new surroundings, after years in a city factory. The site is in West Springfield on the line of the Boston & Albany railroad. The neighborhood is pleasant, with few buildings, even dwelling houses, in the immediate vicinity, with the exception of the main repair shops of the Boston & Albany railroad. Yet the location is easily accessible from the city.

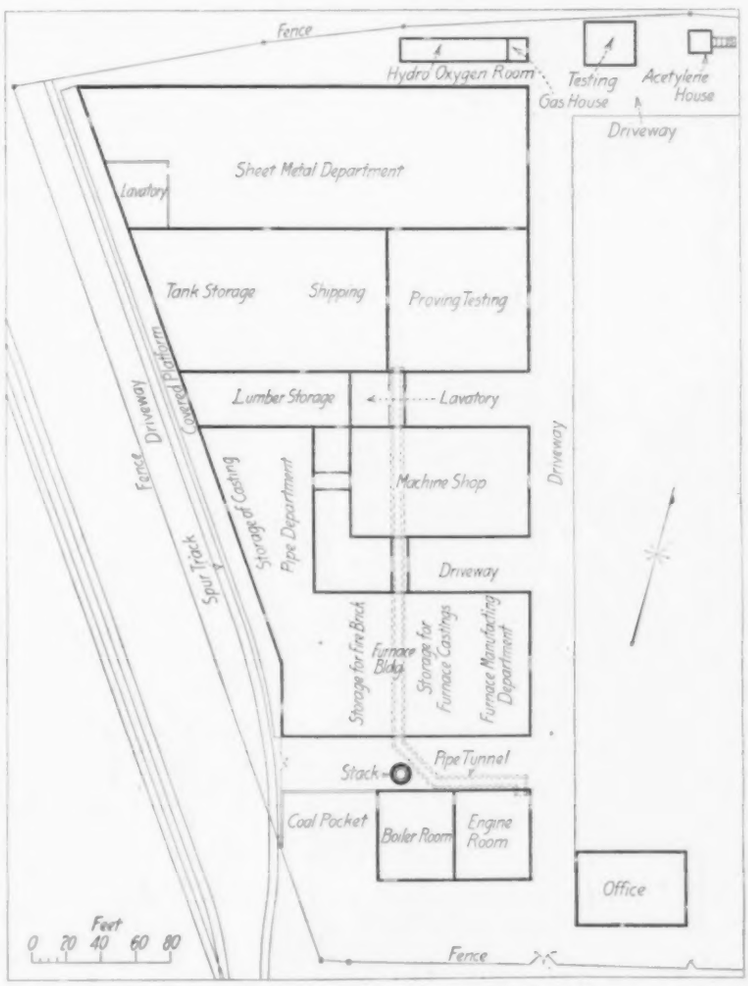

Fig. 2—The Lay-Out of the Gilbert & Barker Works

The company's product is considerably diversified, as the result of evolution from the gas machine for lighting buildings and for industrial purposes in works located away from public sources of supply, which was the original specialty. The line includes apparatus for burning fuel oil and generating fuel oil and illuminating gas; gas and fuel oil furnaces for the treatment of metals; oil storage systems, pumps for handling gasoline, kerosene, oils and other liquids, and tanks of all description to contain fluids.

A Scientific Works Lay-Out

The plant was laid out with exceptional skill, not only for the scientific routing and handling of raw materials and products, but in the conservation of land space and the planning for the future extension of every department. The company has arranged for the

utilization of the eight acres to the extreme limit, the idea being that all of this space will be required eventually for buildings. A glance at the plant will show the railroad on the west, a street on the south with the office building hard by, a street on the east and a row of small detached buildings on the north. The latter boundary curves out slightly and the engineers in charge, McClintock & Craig, Springfield, utilized the strip for the location of several of the smaller buildings, taking them outside of the great open space that later will be occupied for the growth of the several departments of the main shops, each of which can be built on 40 ft.

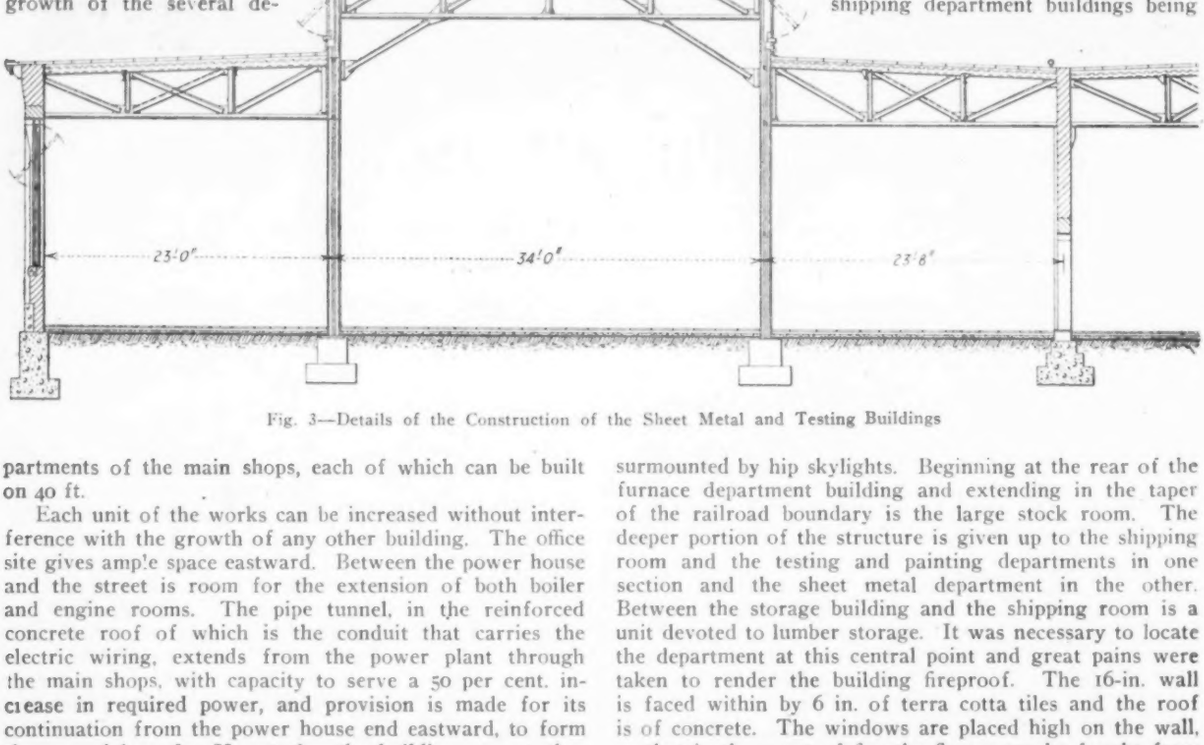

Fig. 3—Details of the Construction of the Sheet Metal and Testing Buildings

Each unit of the works can be increased without interference with the growth of any other building. The office site gives ample space eastward. Between the power house and the street is room for the extension of both boiler and engine rooms. The pipe tunnel, in the reinforced concrete roof of which is the conduit that carries the electric wiring, extends from the power plant through the main shops, with capacity to serve a 50 per cent. increase in required power, and provision is made for its continuation from the power house end eastward, to form the second leg of a U, entering the buildings on another line when enlargements shall have imposed a still greater demand upon the electric current and steam supply. The coal pocket is arranged to receive its contents by gravity from cars standing upon a trestle which will cross the street from a switchback, but this is an improvement reserved for the future.

The Main Shops

The main shops, while in reality constituting a single structure, are made up of several units, separated in part by corridors and in all cases by massive fire doors. The construction is of brick with steel trussed roofs. The manufacturing buildings, with the exception of the two-story machine shop, are of the monitor type, the sheet metal and the testing and shipping department buildings being surmounted by hip skylights. Beginning at the rear of the furnace department building and extending in the taper of the railroad boundary is the large stock room. The deeper portion of the structure is given up to the shipping room and the testing and painting departments in one section and the sheet metal department in the other. Between the storage building and the shipping room is a unit devoted to lumber storage. It was necessary to locate the department at this central point and great pains were taken to render the building fireproof. The 16-in. wall is faced within by 6 in. of terra cotta tiles and the roof is of concrete. The windows are placed high on the wall, so that in the event of fire the flames can be fought from adjoining roofs. A fire door affords entrance to the shipping room where the swing saw and the saw benches are located close at hand to receive the lumber without waste

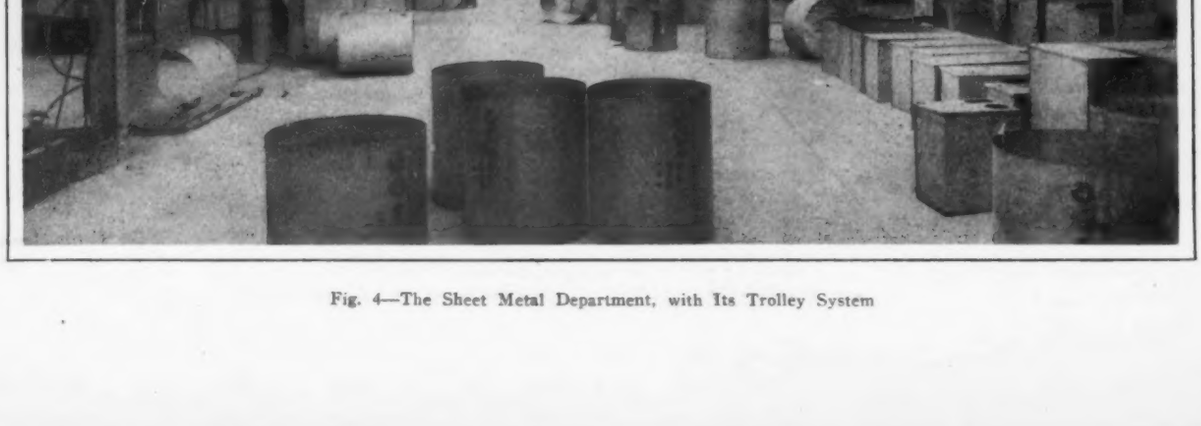

Fig. 4—The Sheet Metal Department, with Its Trolley System

of effort. Extending the entire length of the buildings is the loading platform, 10 ft. wide and 380 ft. long, having doors at the storage, lumber and shipping roofs and the sheet metal department. The exceptional length of the platform and the railroad siding is a necessity, for the company ships a number of carloads of product daily, in addition to the receipt of raw materials. At the old shops everything had to be hauled by wagon to the freight yards so that the economy resulting from the changed conditions is a very important one.

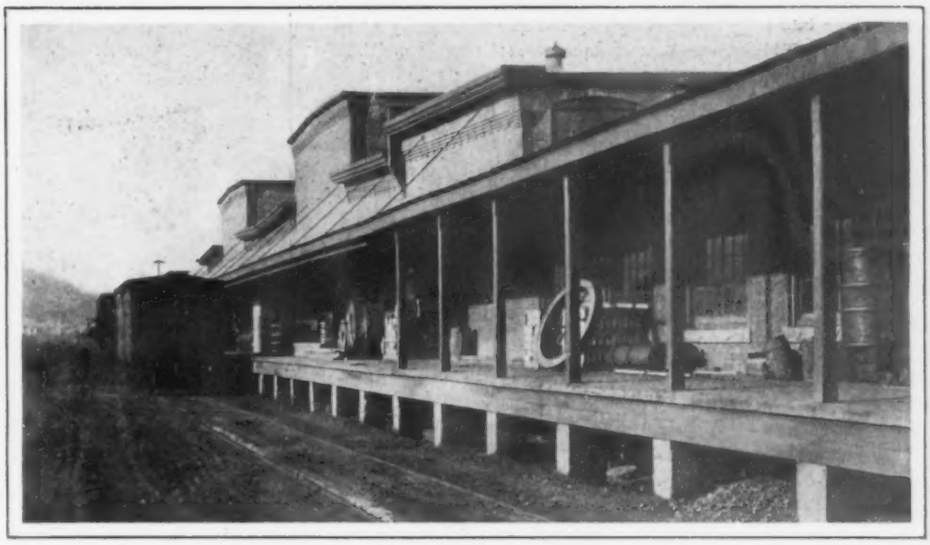

Fig. 5—A Section of the Long Loading Platform

The routing of the product has been worked out in much perfection of detail. Lumber goes direct from the car to its storage and thence to the machines that cut it up, which constitutes a convenience of much consequence, for crating is done on a large scale, especially in the preparation of tanks for shipment. The sheet metal is taken direct from the cars to racks located just within the door of the sheet metal department, and, as required, is delivered to the floor for the building of tanks of which the company produces a large number daily ranging in capacity from one barrel upward.

The runway of the trolley system extends through this room from the racks, with laterals serving the northern bays, and curves at the farther end to enter the testing and painting department, whence it passes on to the shipping room and the loading platform, forming a great U. In planning for extensions of the buildings the runway was not overlooked; the legs of the U can easily be lengthened with the growth of the buildings which they traverse. Even the partition wall separating the testing and shipping departments was erected without bonding and without being carried up to form a fire cut-off in the roof, and when the time comes to add to the buildings and change the apportionment of space between departments the wall can be pulled down and re-erected from its own bricks.

The Acetylene Generating Plant

With the rapidly increasing use of oxy-acetylene welding in the fashioning of metals, the guarding against danger of the ignition of acetylene gas and the resultant explosion is a matter of much importance. The risk is exceedingly small when proper precautions are insisted upon. Yet the possibility must always exist, as is well attested by the rules of the underwriters. The fire hazard in relation to other buildings of a plant is one factor, and the danger to human life is of still greater moment. In establishing the Davis-Bournonville process on a large scale, for the substitution of welding for riveting and soldering in the manufacture of tanks, the Gilbert & Barker Company adopted unusual measures by the erection of an acetylene generator building especially designed to minimize consequences in the remote contingency of an explosion. The details of the structure are shown in Fig. 6. Its location is at the rear of the lot well away from other buildings.

The purpose of the engineers was to direct the force of the possible explosion, by creating a well defined line of least resistance, upward and away from the other parts of the plant and from the streets. The building is of brick set on concrete piers. The south wall, that toward

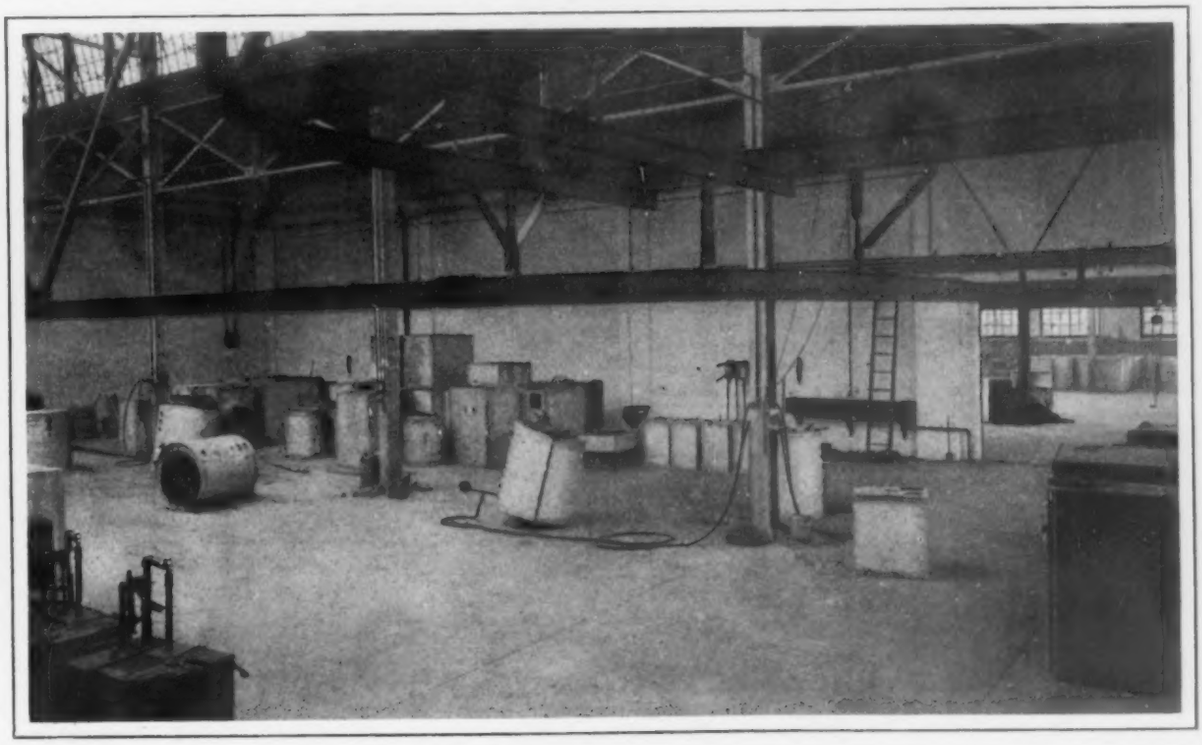

Fig. 6—The Testing and Painting Department

the office building, is 16 in. thick, and the side walls 12 in. The north wall is the weakest member, being 8 in. thick and broken by the large double doors. The skylight roof pitches to the north and the walls on all but this side extend well above the skylight, constituting a bulwark which is another influence in directing explosive forces. The skylight consists of wired glass supported by wooden bars set 14 in. between centers. White pine was selected for the purpose because it will not splinter when shattered. No doubt exists that in the emergency the roof would give instantly and the doors would blow outward, exhausting the force of the explosion and projecting upward whatever debris might result. The skylight bars are channeled on each side to gather the moisture of condensation of the glass and carry it out of doors. An important reason for selecting wood is that it collects no condensation itself and consequently there can be no dripping of water, which is an essential factor of safety in the use of carbide. No provision is made for artificial lighting because it was considered safer to avoid all chance of a spark and to restrict entrance to the building to daylight hours. Fixed Louvres at the top of opposite walls provide constant ventilation.

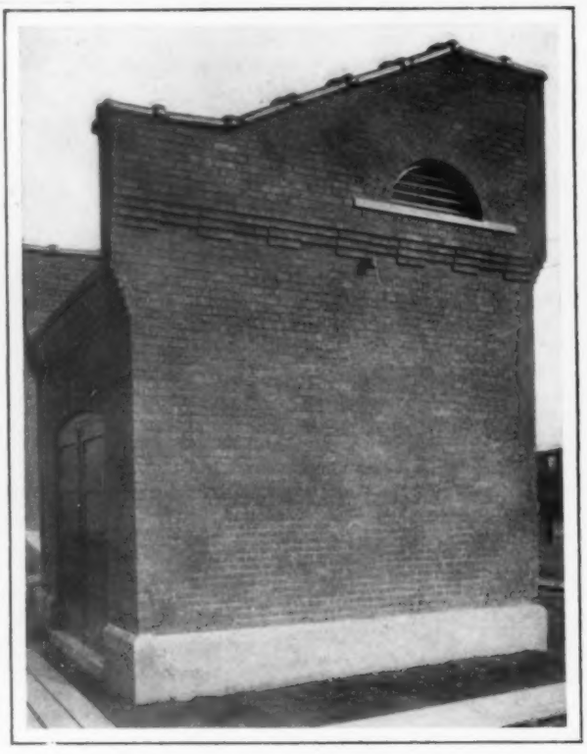

Fig. 7—The Acetylene Generator Building

The Disposal of Carbide Residue

Equal care was given by the engineers to the disposal of the residue of the carbide; in other words the slack lime which remains after the gas has been extracted. As the sewerage system empties into the Connecticut River, the rules of the state Game and Fish Commission forbid this channel of disposal, because lime is death to fish. Therefore, a complete sewage disposal plant on a small scale was installed, designed on the original lines demanded by the special purpose. The problem was to save the lime, which has a commercial value, and to get rid of the liquid.

A tank having concrete walls and floor was built in the ground adjacent to the building, to receive the contents of the carbide chamber when the bottom of the generator is dropped. The tank is 6 ft. wide, 15 ft. long and 3 ft. deep and is divided into what may be termed four compartments. The first two partitions consist of a flashboard at the bottom and a screen of 300 mesh wire above, while the third partition is made up of two 6-in. flashboards. When the exhausted carbide is dumped most of the lime is caught by the screens and the greater part of the residue has settled when it reaches the third compartment and is caught at the bottom by the flashboards. The fourth section of the tank is directly over a blind cesspool into which the water, when released by the removal of the upper flashboard, makes its way through a grating. As the soil consists of fine over coarse sand the water seeps away quickly in the ground. The removal of the lime from the tank is a simple task, for the planks which cover it are easily removed and the contents are shoveled away. The various buildings of the plant are numbered and by chance the acetylene house is No. 13.

The autogenous welding plant includes a complete equipment for the production of oxygen by the electrolysis of water. Some 75 k. w. will be taken from the company's power plant for this purpose. At present the hydrogen is permitted to pass off in the atmosphere, but a market for it is a probability. The installation occupies the larger part of the building just east of the main shops, the other end being given over to the machine which produces fuel gas. This apparatus is a standard design of the Gilbert & Barker Company, automatically generating gas from gasoline and regulating the output to the demand.

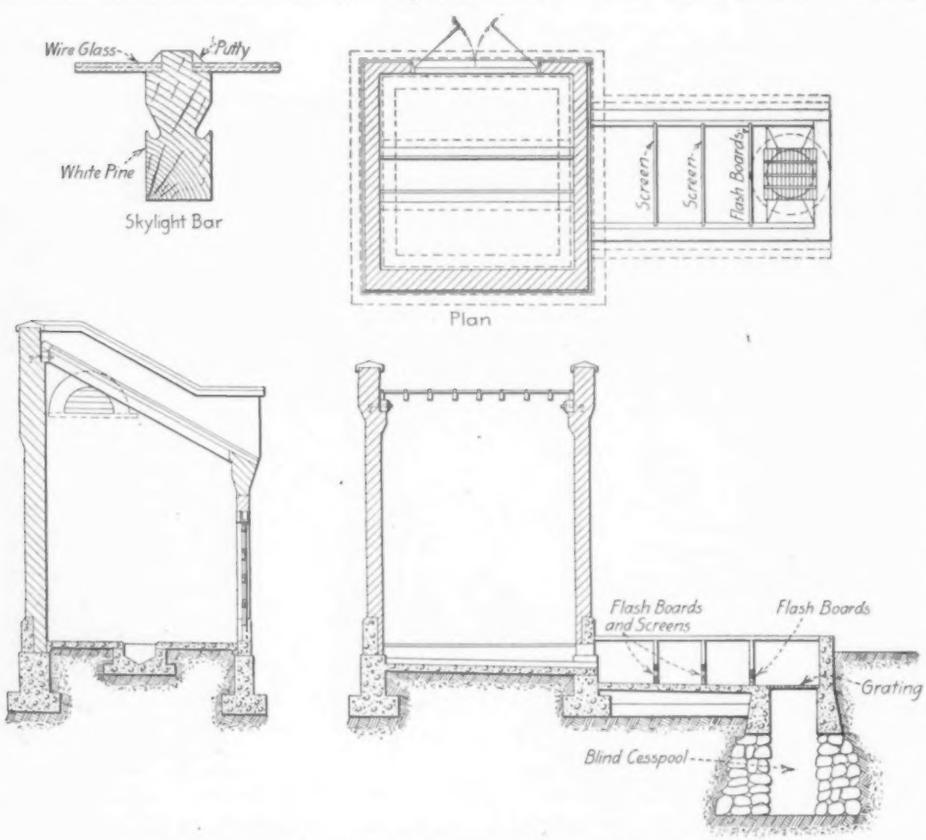

Fig. 8—Details of the Acetylene Generator Building and the Disposal System

Another of the detached buildings is the laboratory where various tests will be made in connection with the company's products and the materials from which they are manufactured. At the present time a series of experiments is being carried out in a temporary furnace to determine the qualities of various kind of fire brick. In the halftone showing a corner of this department is seen the com-

pany's latest model of rotary air compressor and oil pump for feeding fuel oil gas to furnace burners.

The Sheet Metal Racks

The racks for storing sheet metal were built by the company from its own design. The load is great and the construction must be most substantial. The racks consist of heavy iron pipe with ordinary fittings of corresponding size. The columns are built up of short sections of 4-in. pipe, those in the outer row fitting, alternately, crosses and T's, the former taking the longitudinal supports which pass through them in long sections, the latter the lateral supports which pass through T's on the intermediate columns. The rack is further strengthened by longitudinals connecting the central columns.

The power plant is a model for works which require a moderate amount of power. The illustrations show the Cooper high speed Corliss type engine direct connected to a General Electric generator; the high and low pressure air compressors and the switchboard, together with two of the Gilbert & Barker all metal roll top cabinet oil tanks. A traveling hand crane spans the room. Experience has proved that such a crane pays for itself in the installing of engine room equipment.

Entering the main building from the south the first section is the furnace department. In this room is the testing platform which is used in proving the accuracy of the company's self-measuring pumps. The apparatus is wholly original. The platform is supported by columns made of heavy iron piping. These pumps are built for varying lengths of lift and, therefore, it is necessary that the small tank from which the fluid is pumped during testing and adjusting be movable for hight on the columns. Each tank is held in a yoke and is counterbalanced by weights within the columns, and is locked in position by pins fitting holes drilled in the columns at frequent intervals. Beyond the furnace department is the machine shop building. Only the first floor of this structure is now occupied for manufacturing, but the company has ordered an equipment of the latest types of machine tools which will be installed on the second floor.

When the tanks are painted their surfaces are heated by steam, the condensation from which is drained by rolling them over a grill of large area. This supports a pan pitched to drain at the center and loosely connected to the sewer through a pipe in the tunnel. The whole arrangement can be lifted out in case a long pipe has to be laid in the tunnel or other work of similar magnitude performed.

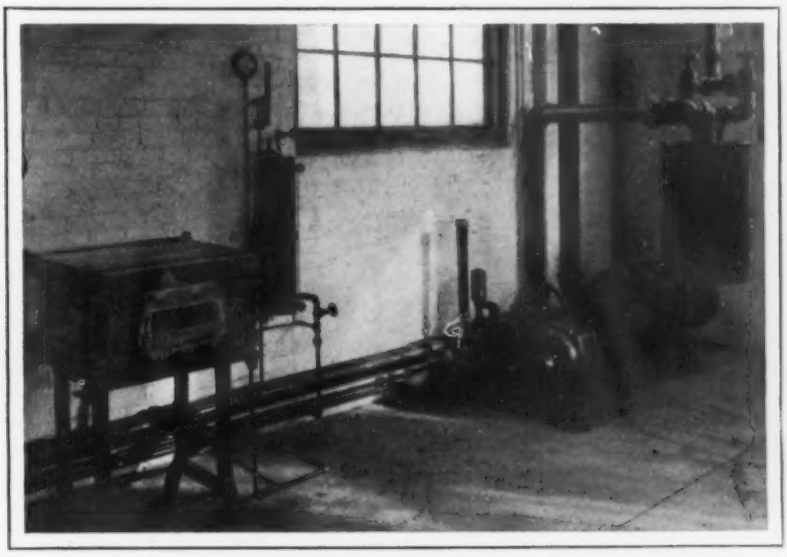

Fig. 10—A Corner of the Testing Laboratory

The stock room is an important department. The company maintains a very complete supply of parts of its various products as well as completed apparatus of certain types, and the room is always filled, steel racks and bins affording convenient storage. The cost system maintains a strict account of stock and operates to make the convenience of storage highly efficient.

A word should be spoken concerning the sanitation of the works. The buildings are very finely lighted from wall windows and from skylights. The ventilation is ample. In this the skylight apparatus of the G. Drouve Company assists materially. The washrooms and toilet rooms have the most modern fittings. Each man has his private steel locker and in each department is a sanitary drinking fountain.

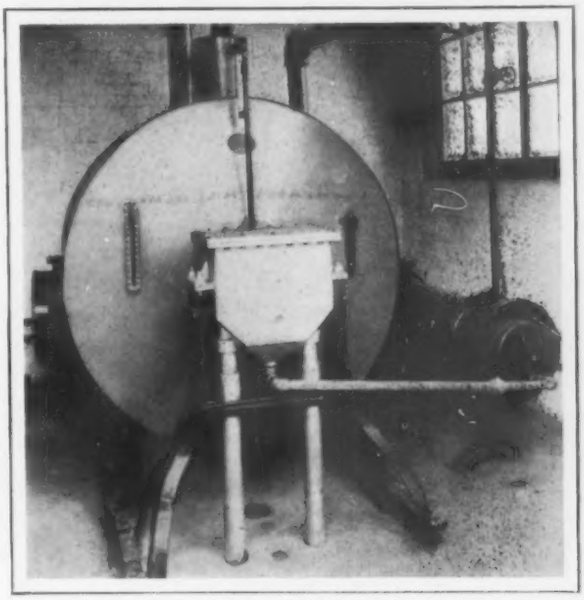

Fig. 9—The Fuel Gas Generator

The Steel Corporation to Advance Wages

The following announcement was made on Tuesday, December 24, by Chairman E. H. Gary, of the United States Steel Corporation:

"At the meeting of presidents of subsidiary companies of the United States Steel Corporation held last Thursday, it was unanimously voted that there should be made in the near future adjustments of the wage scales which will result in material increases, particularly with respect to common labor; and at the meeting of the Finance Committee held today it was decided to recommend to the presidents that they make the adjustments proposed at such times and in such amounts as may be determined. The exact amount of increases and the date at which they will go into effect are being considered and will be determined within a few days."

It is understood that details of the various advances are now being worked out and that they will result in some districts in establishing a daily rate close to $2 for common labor, which for the most of the past year has been receiving from $1.75 to $1.85 at the steel works of the country.

The Metal Manufacturers' Association of Philadelphia held its annual meeting December 20, electing the following officers: President, E. L. Langworthy, Adams & Westlake Company; vice-president, J. H. Schwacke, Wm. Sellers & Co., Inc.; treasurer, Thomas Evans, Eynon-Evans Mfg. Company; councillors to serve for two years, Wm. S. Hallowell, Harrison Safety Boiler Works; W. J. Hagman, Bement-Miles Works; E. A. Fisher, Otto Gas Engine Works. The annual banquet will be held at the Bellevue-Stratford Hotel January 30.

Fig. 11—Testing Platform for Proving Self-Measuring Pumps

Blocking the Other Fellow's Efficiency

A contribution in a recent bulletin of the Efficiency Society, 29 West Thirty-ninth street, New York, by Francis W. Hoadley, assistant treasurer of the society.

There seems to be a tendency on the part of many firms and individuals, who use great care in carrying out the details of their own systems, to ignore clearly indicated details of the other fellow's, thus causing in many cases much loss of time. No matter how efficient any system may be in operation, it can be hampered and made ineffective, if absolutely no attention is paid to plain and clearly indicated references, and while perhaps a little time is saved for the person who ignores the other fellow's references, a much greater amount of time is wasted for the other fellow.

To illustrate. In one day recently there were received among others at the office of the Efficiency Society six checks sent in payment of accounts, with absolutely nothing on them to show what they were for and who should be credited. Four were voucher checks, the others checks and vouchers made out on the forms of the firms remitting. Each carried several references by number and other signs to the accounting systems of the senders; not one gave the slightest indication by either name, date or reference number to the records of the receiver.

One of these voucher checks will illustrate the amount of time wasted for the society. It came from a large firm in a large city; was on an elaborate form, carrying many references to *their records,* but no information

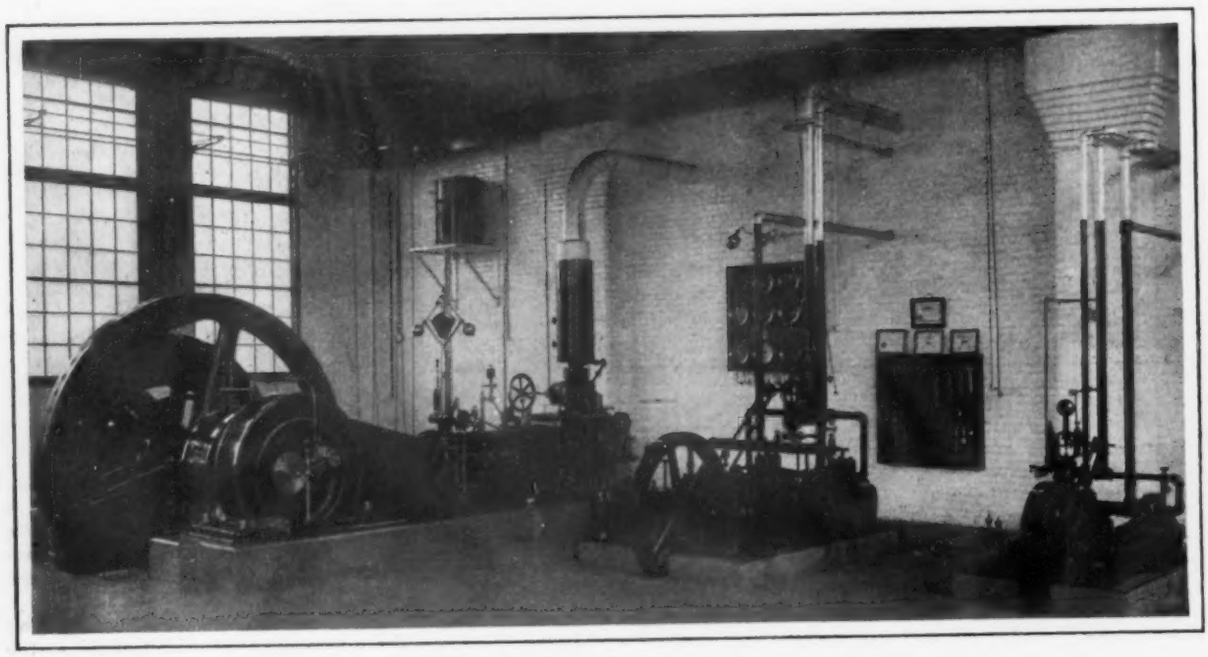

Fig. 12—The Power Generating Equipment

whatever to show the society what and whom to credit with the amount received; no name of the person on whose behalf payment was made, no date of the society's bill, nothing but the amount, fifteen dollars and some odd cents.

The process of identifying this remitter follows:

(*a*) Card index of members consulted and search made under the city from which the check came for a member connected with the company making the remittance. This chanced to be a large concern, connected with which we have several members.

(*b*) Each of these member's accounts had then to be looked up, when it was found all had paid.

Fig. 13—Racks for the Storage of Sheet Metal

(*c*) Using the odd cents as a clue, a search was made, which showed that several men owe that sum, and, after searching all through the accounts of these men, it was found that a certain man owed such a sum, who, though not residing in the city from which the remittance came, was the representative at another point of the concern making the payment.

(*d*) On reference to that man's account, it was found that he owed for both dues and papers the amount called for by the check. This, though not positive evidence, was considered sufficient to warrant crediting him with the amount received.

As a matter of interest, a note was made of the time consumed in tracing out this matter, the time being twenty-one minutes. Twenty-one minutes wasted for the reason that the concern remitting omitted to give the name of the debtor or any direct reference to identify him; an operation that would have taken but a few moments of their time, the information being before them when the voucher check was drawn.

It is true that this voucher could have been returned to the sender with a request for information as to the person to be credited, but this would have further delayed payment and meant extra expense for postage and time for both parties concerned.

Ignoring a signal has caused many a railroad wreck; ignoring signals in the way of reference to the other fellow's system wastes time, which, though small in each individual case, amounts to a large total of wasted time for all in a year.

No system should be so elaborate as to require any unnecessary expenditure of the other fellow's time, though there may be some at present that are; but when reasonable information is requested and not given, we should remember that ignoring the requirements of the other fellow, and remembering ours alone is sure to count much against efficient results, while a little consideration for others and a moment's time to meet their clearly indicated and rightfully desired requirements will make much toward more general efficiency.

If each would make it a rule to "lend a hand" in such matters all would be the gainer, and though the matter written of above may be a small thing in itself, still it is one of the little cogs in the machinery for business operation which, if neglected, cause delay and inefficiency in obtaining rapid and accurate results.

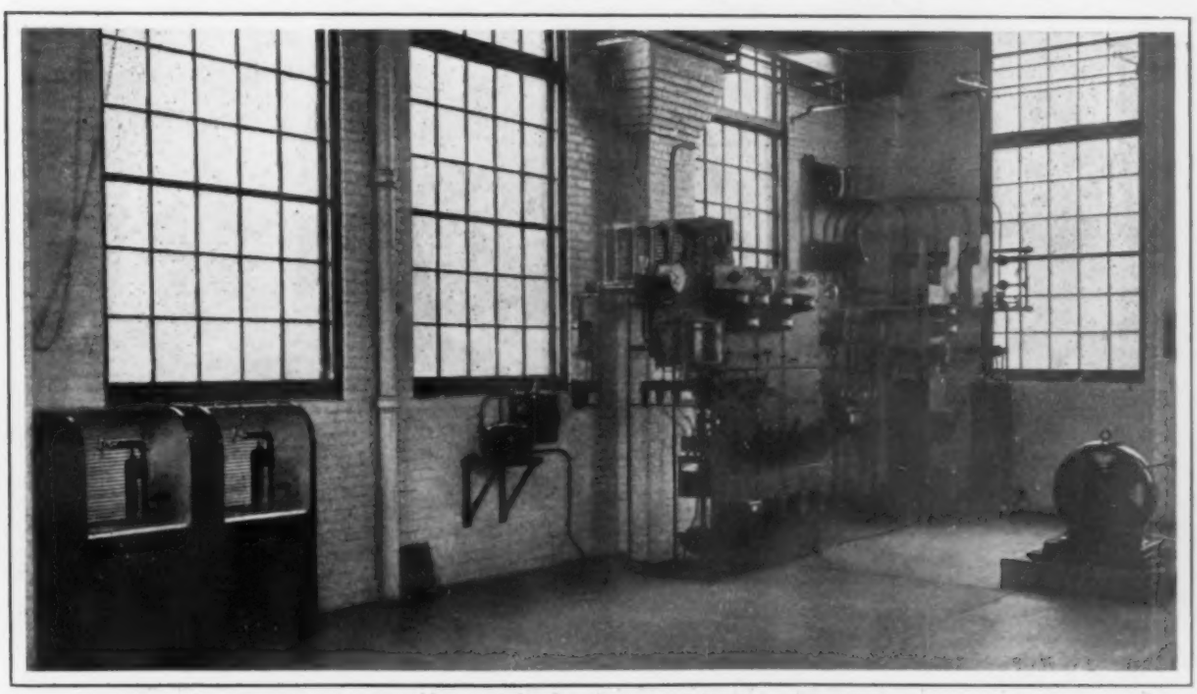

Fig. 14—Corner of Engine Room, with Oil Tanks and Switchboard

A Cylindrical Grinding Machine

The Cincinnati Grinder Company's Manufacturing Type for Plain Heavy Work

The 12-in. plain cylindrical grinding machine here illustrated is designed by its builder, the Cincinnati Grinder Company, Cincinnati, Ohio, as a manufacturing tool for grinding work, either straight or taper, such as shafts, rolls, spindles and tubing, which can be revolved on dead centers within the range of the machine. The wheel spindle is of a special analysis steel hardened, ground and lapped, and runs in phosphor-bronze boxes which provide the means of compensation for wear. The wheel head is proportioned to withstand the severest service and is held in position upon the long and wide ways of the wheel slide by gravity, which precludes the possibility of "jumping in" or "sticking" when delicate adjustments are made or of lifting under heavy cuts. Its slide is secured by heavy bolts and dowel pins to the supporting pedestal, which extends to the floor and is cast integral with the water tank and base. The automatic cross feed has a range varying from .0025 to .005 in. for each reversal of the table, which provides a diversity of changes from the coarseness required for removing stock rapidly on large diameters to one of sufficient fineness to give a high finish to delicate work. The feed is thrown out automatically when the required size has been reached and is regulated by the turning of a thumb wheel on the front of the machine.

The swivel table has its bearing on the sliding table and pivots on a heavy hardened and ground central stud. It can be set at an angle to the ways, permitting the grinding of tapers without throwing the head and footstock centers out of alignment. It is graduated to read in degrees and taper in inches per foot, adjustment being made by rack and pinion at the table end, direct-reading scales indicating the position. When it is desired to move the table through a greater distance than is indicated by the graduation marks on the scale, no special disconnection is required, the adjusting device being so designed as to leave the table free to swing through an arc limited only by the wheel slide.

The sliding table has a reciprocating motion on the ways of the main base casting, controlled by adjustable dogs which operate against the reversing lever. This actuates a clutch of the load and fire type which is contained in the automatic feed plate, constituting a complete unit in itself, bolted to the front of the machine and easily removable. The travel is entirely independent of the work speed or speed of the wheel, which permits of traversing the work at full width of the wheel face at each revolution. The power transmission is through worm gearing which insures a smoothness and uniformity of motion. The reversing dogs afford the fine adjustment which is necessary when grinding to shoulders, and permits of traversing the table beyond the points of reversal without disturbance to the initial setting, as they readjust themselves when the table has been returned to its original position.

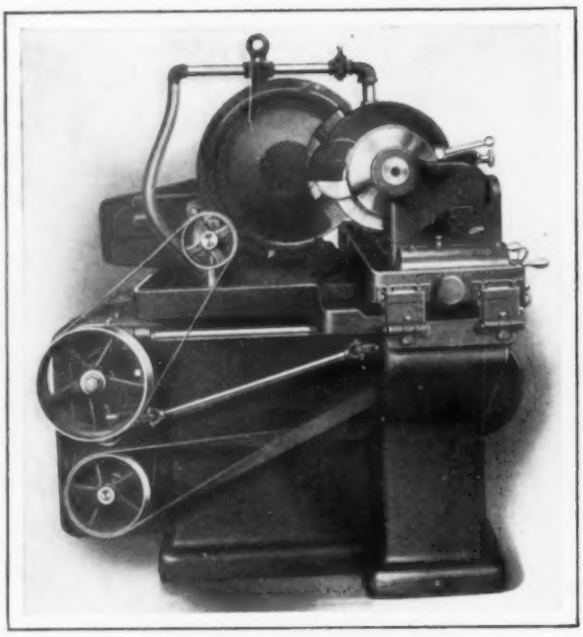

Fig. 2.—End View of Plain Cylindrical Grinding Machine

The headstock slides on the ways of the swivel table and is locked in position by a large hook-bolt which slides in the ell slot. It has a hardened, ground and lapped hollow spindle, the hole being tapered at its front to receive the work carrying center. The work is revolved through powerful gearing. A supporting way all the time directly under the work replaces the overhanging type of headstock. Alignment is preserved through the use of an inverted V. The footstock is secured to and preserves the alignment on the swivel table in the same manner as the headstock, and its spindle, of the same taper, is operated by a hand wheel.

The back rests for supporting long slender shafts are rigid and capable of delicate adjustment and are universal in their movements. The base has a three-point bearing and is made in box sections, ribbed and braced. The pump is of centrifugal type, its bearings being out of contact with the water. The machine is built in four sizes, respectively 36, 50, 72 and 96 in. between centers, a swing of 12 in. being common to all, which gives ample range in capacity.

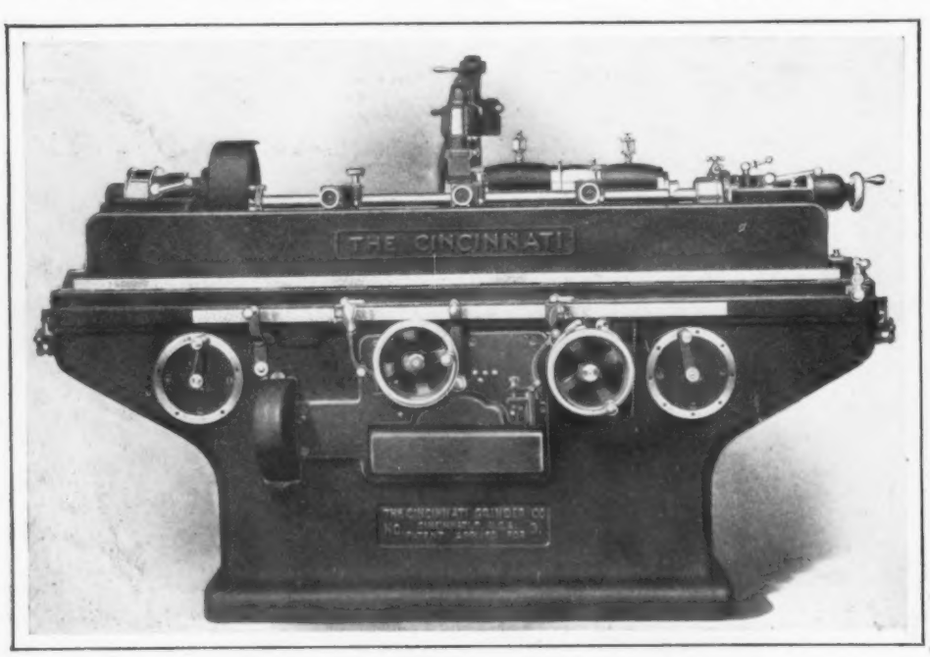

Fig. 1.—A 12-In. Plain Cylindrical Grinding Machine for Manufacturing

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The city of Youngstown, Ohio, has awarded contracts for two 7,500,000-gal. pumping units, one to the William Tod Company, Youngstown, and the other to the Kerr Turbine Company, represented by R. M. Rush, Oliver Building, Pittsburgh. The Tod contract was for a triple expansion reciprocating pump with a duty of 163,000,000 foot pounds, at $72,110. The Kerr contract was for an Economy turbine, direct-connected to a Wilson-Snyder centrifugal pump designed by Albert E. Guy, of Pittsburgh. The price of this was $9,989, and the duty 80,000,000 foot pounds.

The Jones & Laughlin Aliquippa Works

Blast Furnaces, Steel Works and Rolling Mills in Two Groups—Duplexing with the Talbot Process—Town Building

The Aliquippa, Pa., plant of the Jones & Laughlin Steel Company, Pittsburgh, is one of the most important American steel works built in recent years "from the ground up," or by the selection of an entirely new site, in contrast with the process of accretion on a site long used. The work that has gone on at Aliquippa in the past five years without attracting widespread attention has resulted in a plant great not only for the scale on which it was planned but for the extent and modern character of its equipment. In adding the Aliquippa capacity to that already existing at its Pittsburgh works, the Jones & Laughlin Steel Company became the leading independent steel interest, with a possible annual output of 2,000,000 tons of steel ingots. The long established works at Pittsburgh consist of the South Side department, the Eliza furnaces and coke ovens, the Soho furnace and Soho steel works, and the Keystone or structural department, these plants extending along the banks of the Monongahela River for a distance of several miles.

Before the works of the Indiana Steel Company at Gary had been planned, the Jones & Laughlin Steel Company had started buying the site of its Aliquippa department, which is situated on the left bank of the Ohio River in Beaver County, about 20 miles north of Pittsburgh, between the river and the Pittsburgh & Lake Erie Railroad of the New York Central system. Actual work at Aliquippa was begun in December, 1906, when a contract was let to the Riter-Conley Mfg. Company for the building of the first blast furnace, though plans had been made a number of years before. The site was formerly known as Aliquippa Park, a pleasure resort, the name being derived from that of an Indian queen famous in the early history of western Pennsylvania, whose village was situated at about this point on the Ohio.

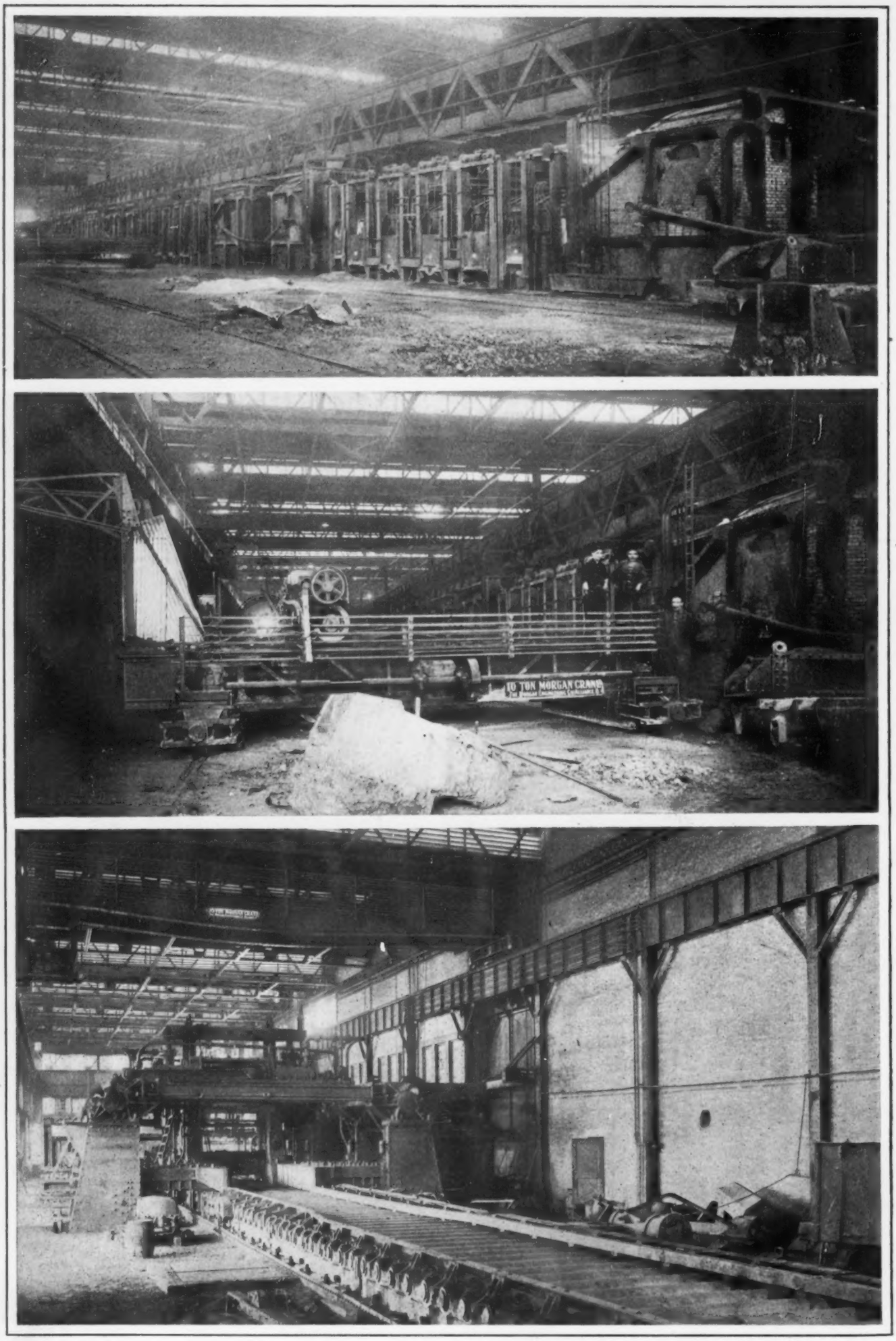
The Aliquippa works were required to take care of the increasing business of the company. The last possible addition had been made to its Pittsburgh works; on account of the prohibitive value of city property and the limitations imposed by the growth of the city up to and around the works, it became necessary to go out into the country.

Town Building

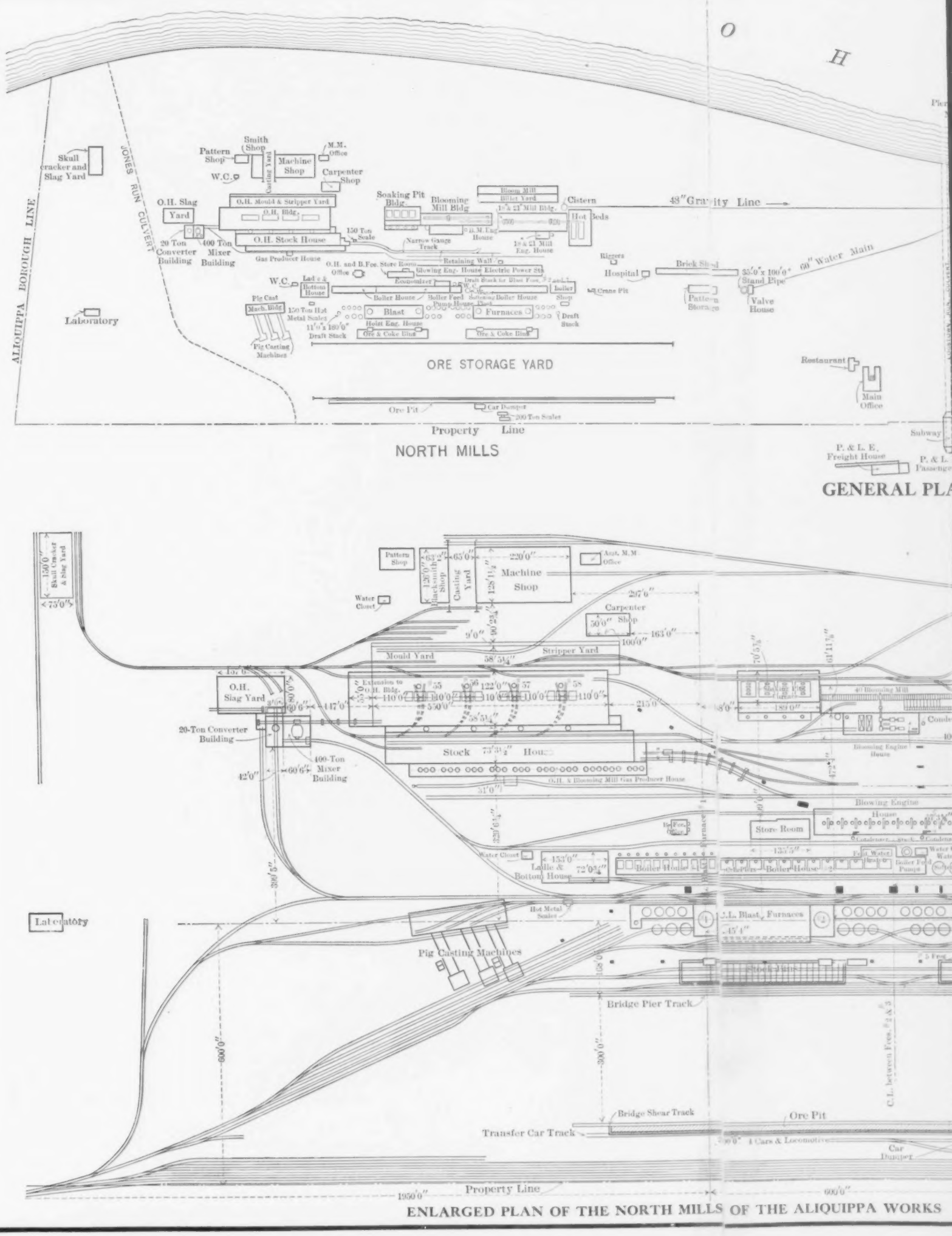
A tract of about 1500 acres was purchased adjacent to the town of Aliquippa. The land was divided into two nearly equal parts by the railroad. One part, a strip 3¼ miles long and ½ mile wide between the river and the railroad, was selected for the site of the works, while the hills and valleys on the other side of the railroad were laid out into a park-like town site, on which 1200 homes, ranging in cost from $1,500 to $5,000, were built for employees and officials. The town was named Woodlawn and is a chartered borough, governing itself. There are macadam streets, a water system, gas for light and heat, electric service, brick paved business streets, grammar schools, high school, churches, clubs, about 30 modern store and apartment blocks, ranging from two to five stories, pay-as-you-enter street cars and a complete police and fire department. The population is 8000. Every house is occupied and building is going on all the time.

The four-track system of the railroad passes between the town and the works and the two are connected by a large subway in which is operated the street car line connecting the works with all parts of the town and also with the adjacent town of Aliquippa, thus affording the

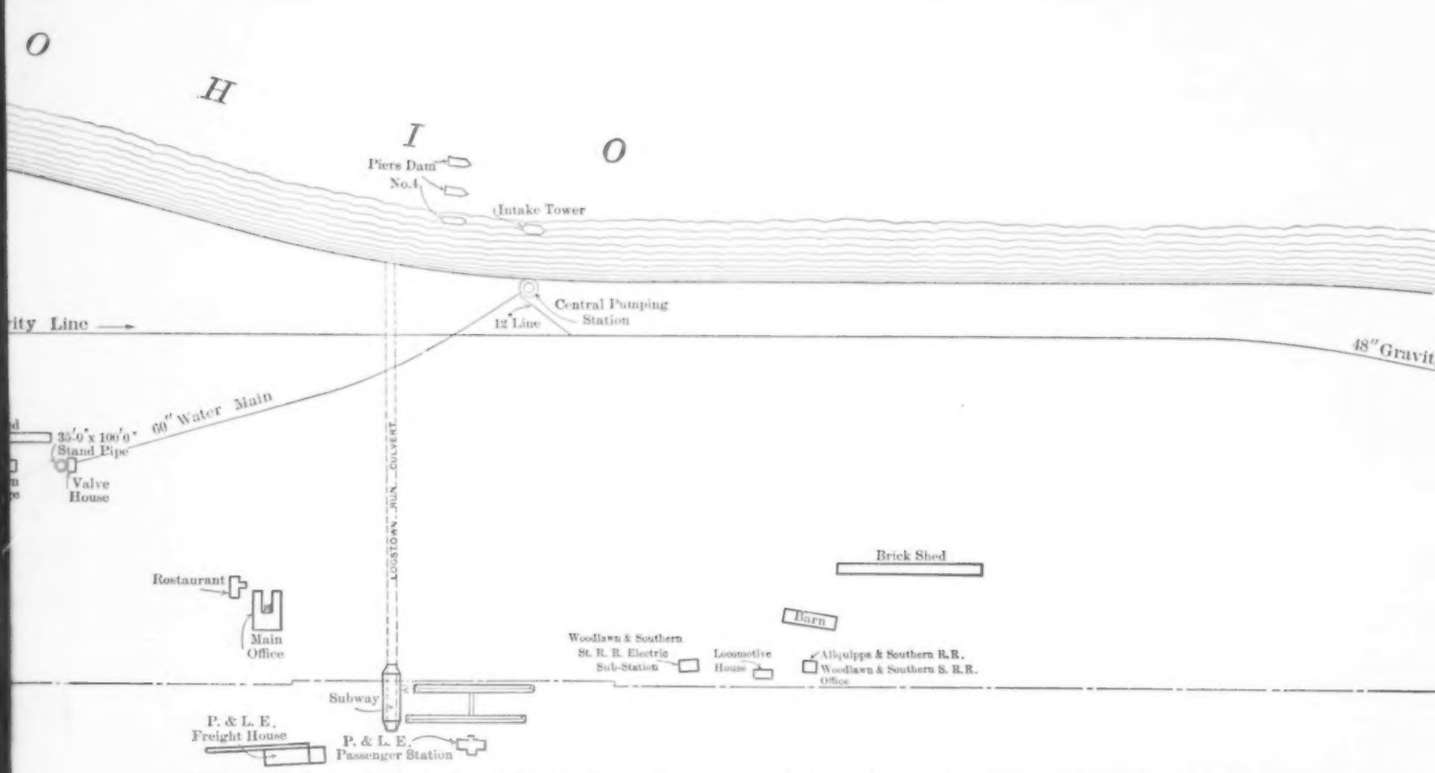
Blast Furnaces Nos. 1, 2 and 3, Aliquippa Works, Jones & Laughlin Steel Company, Aliquippa, Pa. No. 4 Furnace is Not Shown



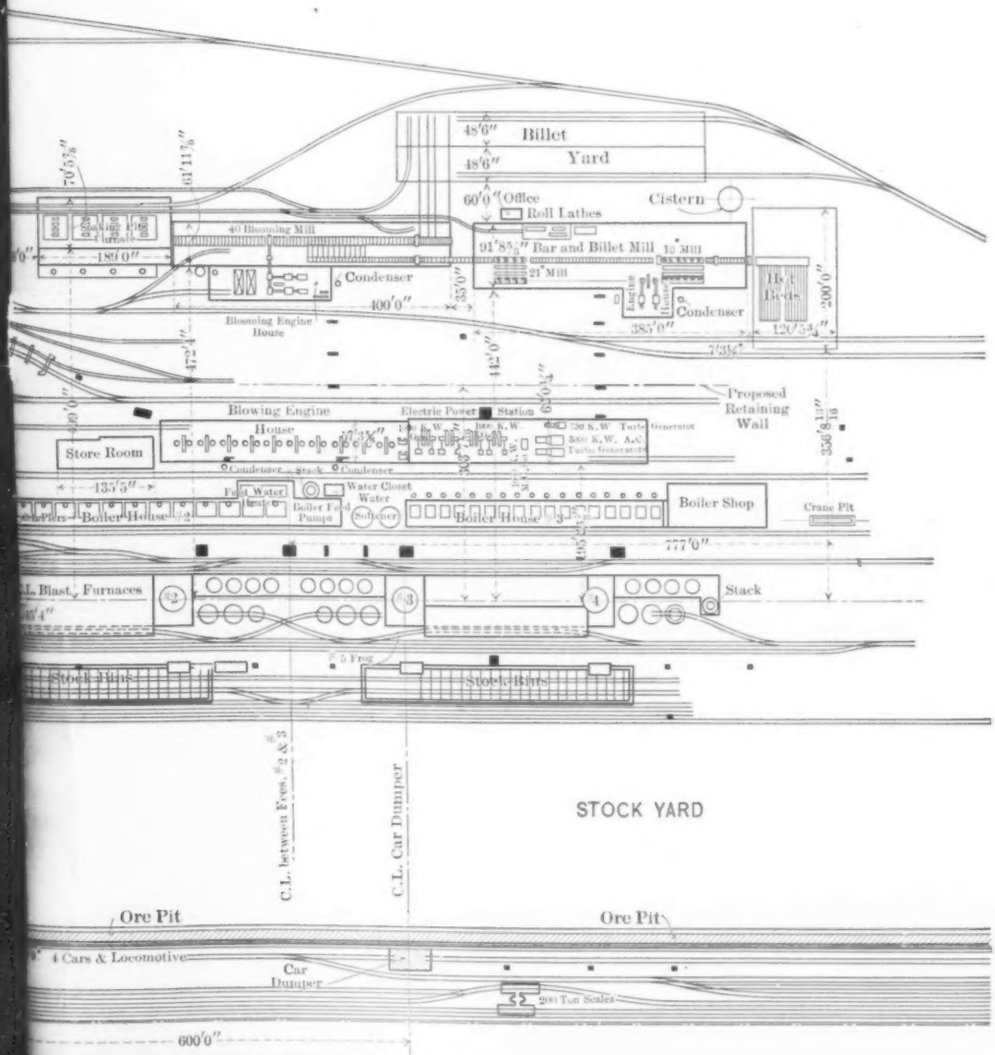
Four Talbot Open Hearth Furnaces with Morgan Charging Machine in Background
Talbot Tilting Furnaces with Morgan Charging Machine in Foreground
The 40-In. Two High Reversing Blooming Mill



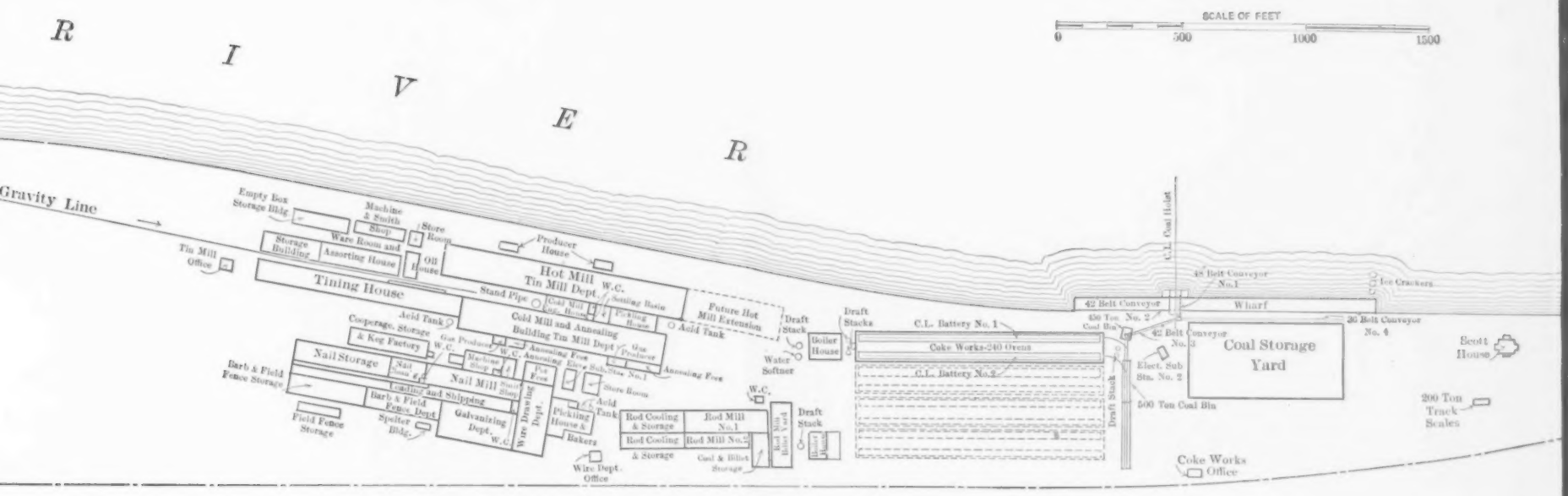
ENLARGED PLAN OF THE NORTH MILLS OF THE ALIQUIPPA WORKS



GENERAL PLAN OF BUILDINGS AND LAND OF THE ALIQUIPPA WORKS OF THE JO

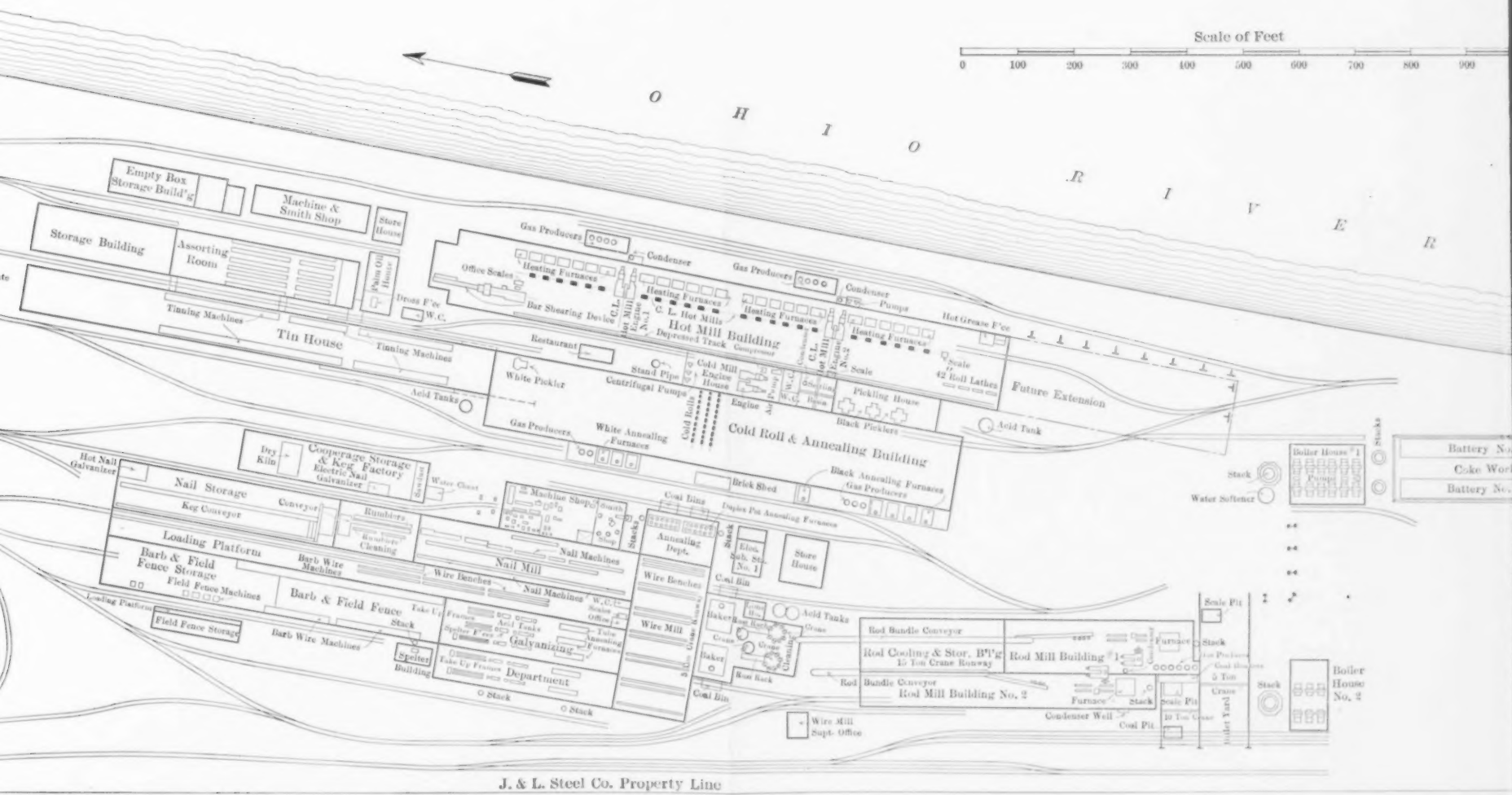


OF THE ALIQUIPPA WORKS



SOUTH MILLS

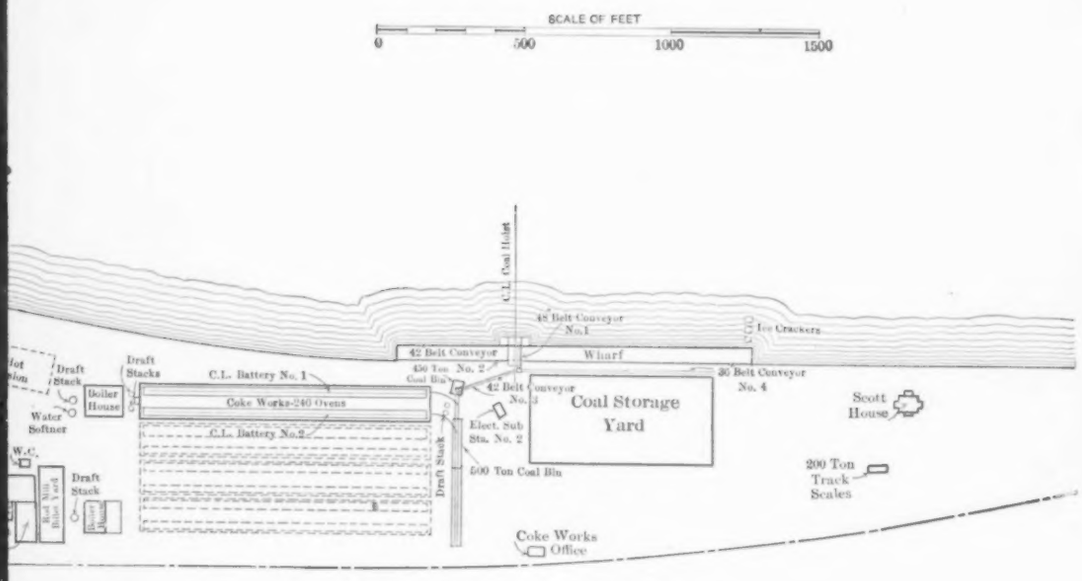
E JONES & LAUGHLIN STEEL COMPANY.



J. & L. Steel Co. Property Line

P. & L. E. (N. Y. C. Lines) Monumented Line

ENLARGED PLAN OF THE SOUTH MILLS OF THE ALIQUIPPA WORKS.



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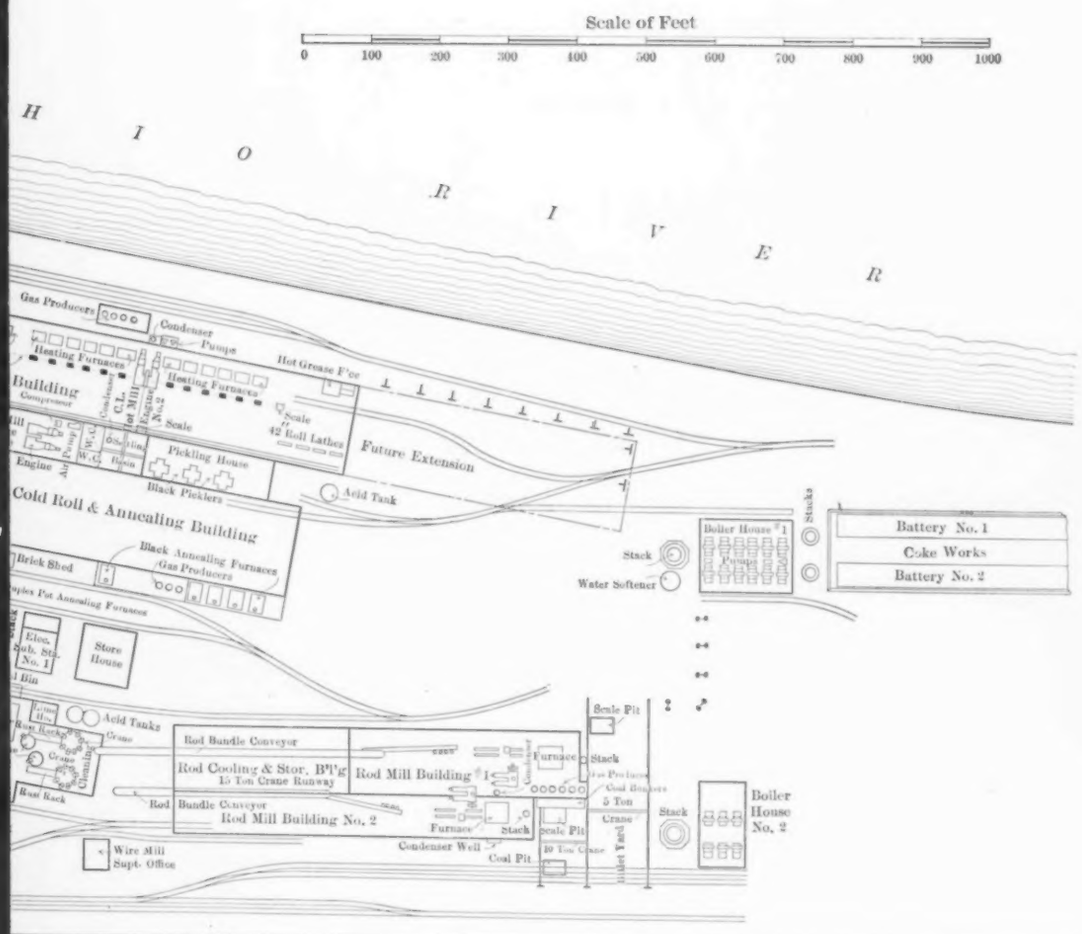
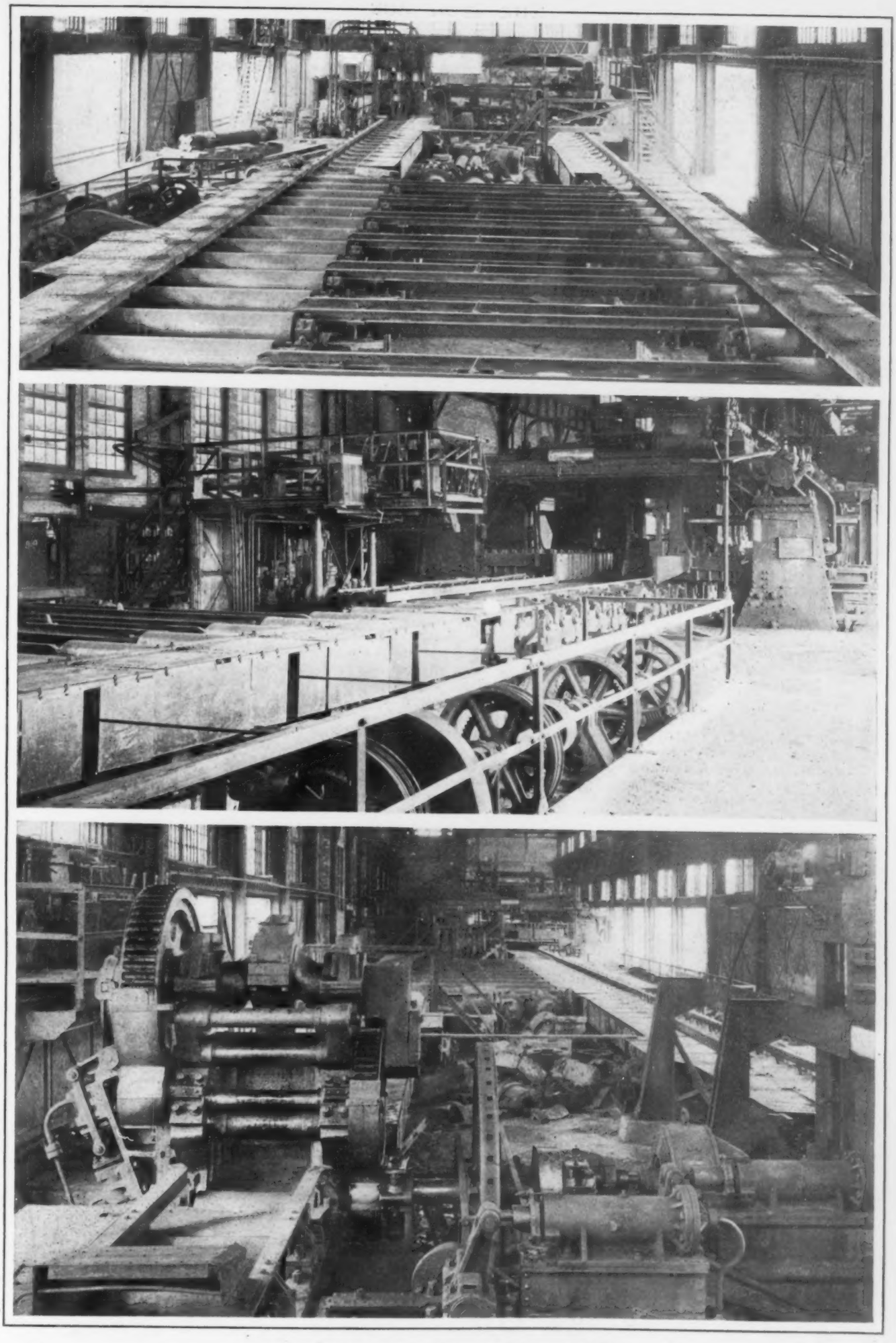
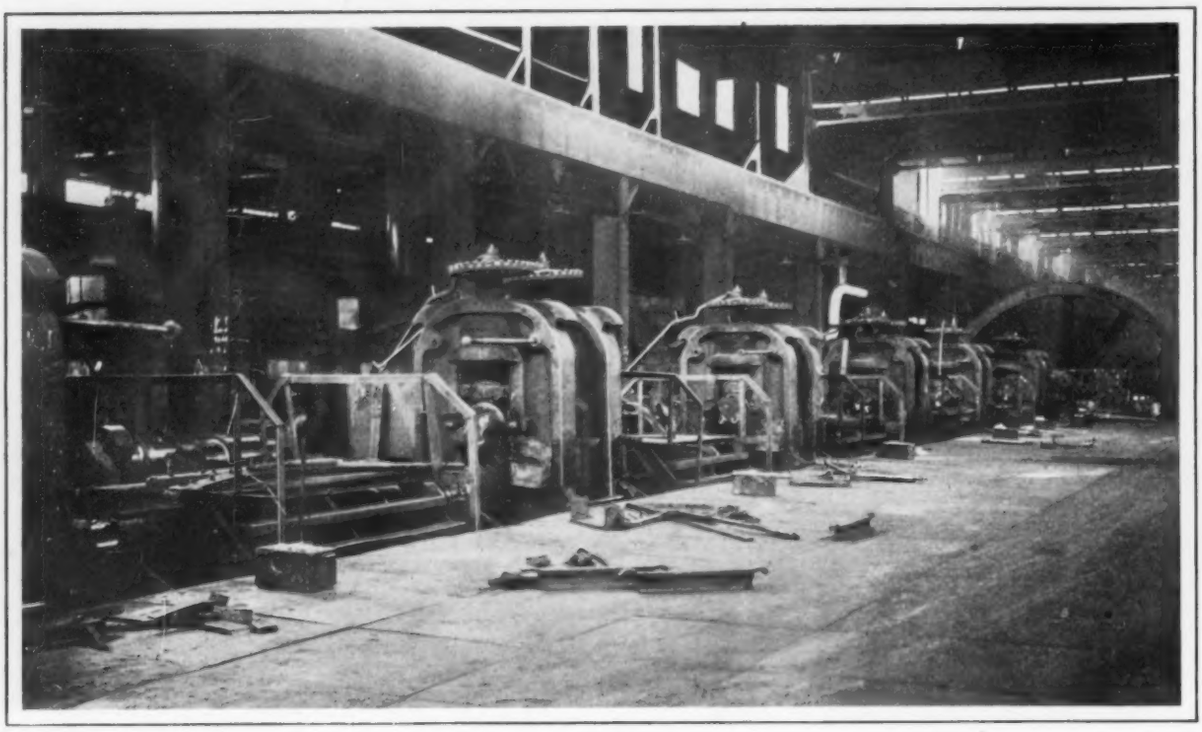


d Line

MILLS OF THE ALIQUIPPA WORKS.



Run-out Table, Transfer and Shear of 40-in. Blooming Mill
Billet Mill and Transfer Mechanism
Billet Mill with Billet Shear in Left-Hand Foreground



Hot Tin Plate Mills, Aliquippa Works

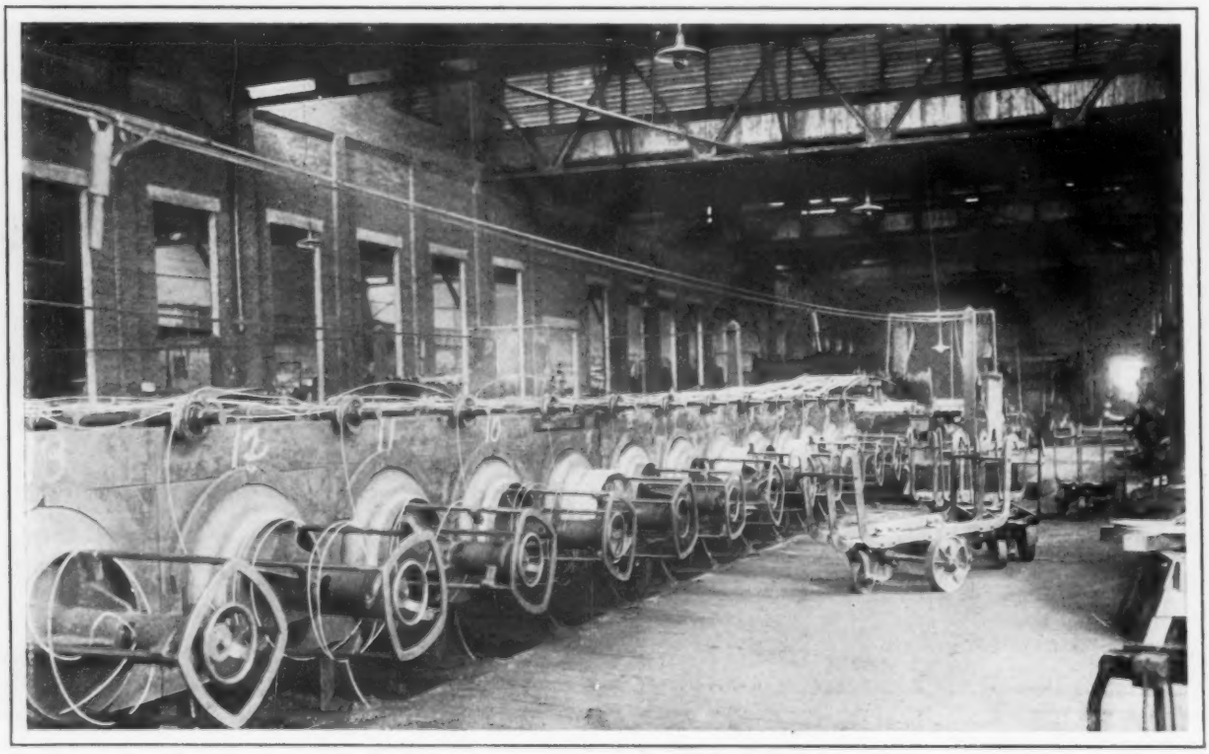
workmen facilities for getting to and from their employment. A new Pompeiian brick station, shelter, platforms and passenger subways make the station of Woodlawn urban and attractive.

The Works Site

The topography of the land reserved for the plant was such that it was possible to construct the various departments on the principle of continuity, with the highest degree of efficiency and the largest economies in the handling of materials, and at the same time leaving ample room for large future developments without having to disturb present features. The long strip of land, with the river on one side and the railroad on the other, permitted of such a layout that the raw materials are delivered at one end, the north, while the finished product comes out at the other, two miles away. The main feature of the Aliquippa works which will strike engineer and steel maker as shown in the accompanying plan, is that of long parallel lines; ore storage yards, blast furnaces and steel mills, side by side at the north end; tin mills and wire mills side by side in long lines at the other end, with coke ovens stretching out beyond, all connected up by the tracks of the Aliquippa & Southern, the company's interworks railroad.

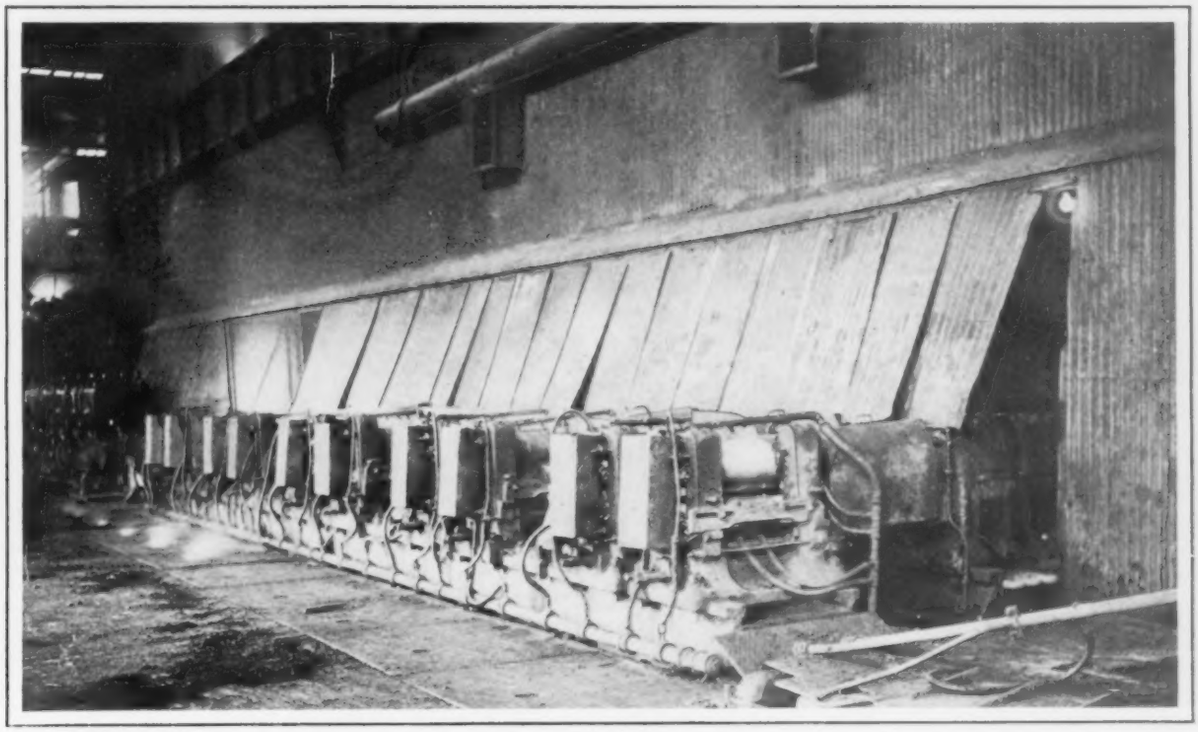
While a good part of the ground was below high water level, it offered an excellent dumping ground for blast-furnace slag, flue dust and cinders, and it has been steadily filled until a large part of it is now above high water mark. Yet there is still room to take care of the slag and cinder for many years.

Not being hampered for space, the company constructed all its buildings with a liberal margin of headroom for



Galvanizing Department, Wire Mills, Aliquippa Works

SIDE GUIDE AND GRIT



Morgan Continuous Rod Mills, Aliquippa Works

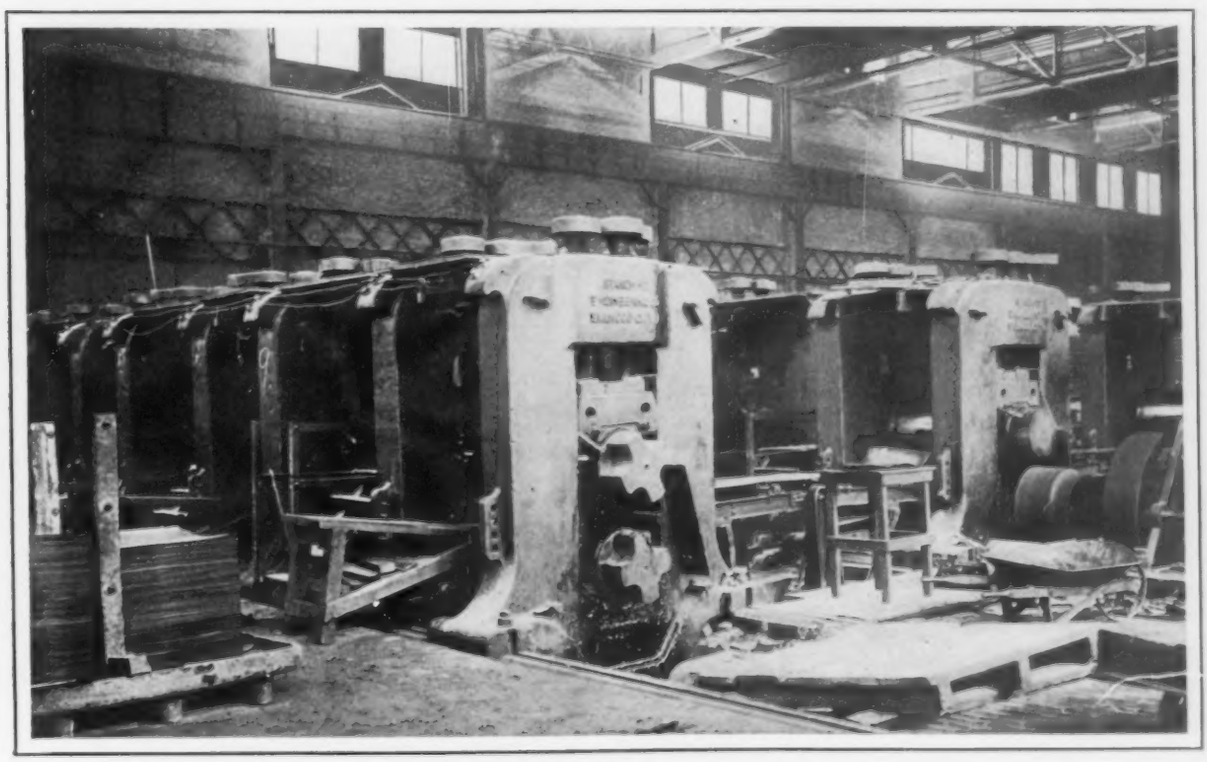
cranes, with ample accommodations for handling materials, for storage and shipping and for light and ventilation for the men. Another feature is the installation of all approved safety devices, while the uncrowded condition of the works in itself tends greatly to reduce the danger of accident. There are two hospitals, one at the north and the other at the south end of the works, with a physician and attendants in charge.

Two great arteries of transportation take care of the traffic of these works—the four-track system of the Pittsburgh & Lake Erie Railroad and the Ohio River. A Government dam about midway of the property makes an ideal harbor or pool at the south end, into which the company's fleet of towboats delivers cargoes of coal in steel barges of its own construction from its coal mines 70 miles up the Monongahela River. All the coal for the coke ovens and for the power plants is delivered by the water route, which also affords facilities for delivery of materials from the city works. The ore and limestone come in by rail to the great storage yards at the north end. The finished product goes out by rail.

The plant now completed consists of four blast furnaces, four Talbot tilting open-hearth steel furnaces, a blooming mill, a billet and bar mill, general shops and offices—all these are at the north end; at the south end, the tin plate department and rod and wire mills, with 600 coke ovens under construction.

Blast Furnaces

The four blast furnaces are 22 x 90 ft. each, and are equipped with four Kennedy-Cowper stoves, 22 x 100 ft., of the two-pass type. Three of the furnaces were built by the

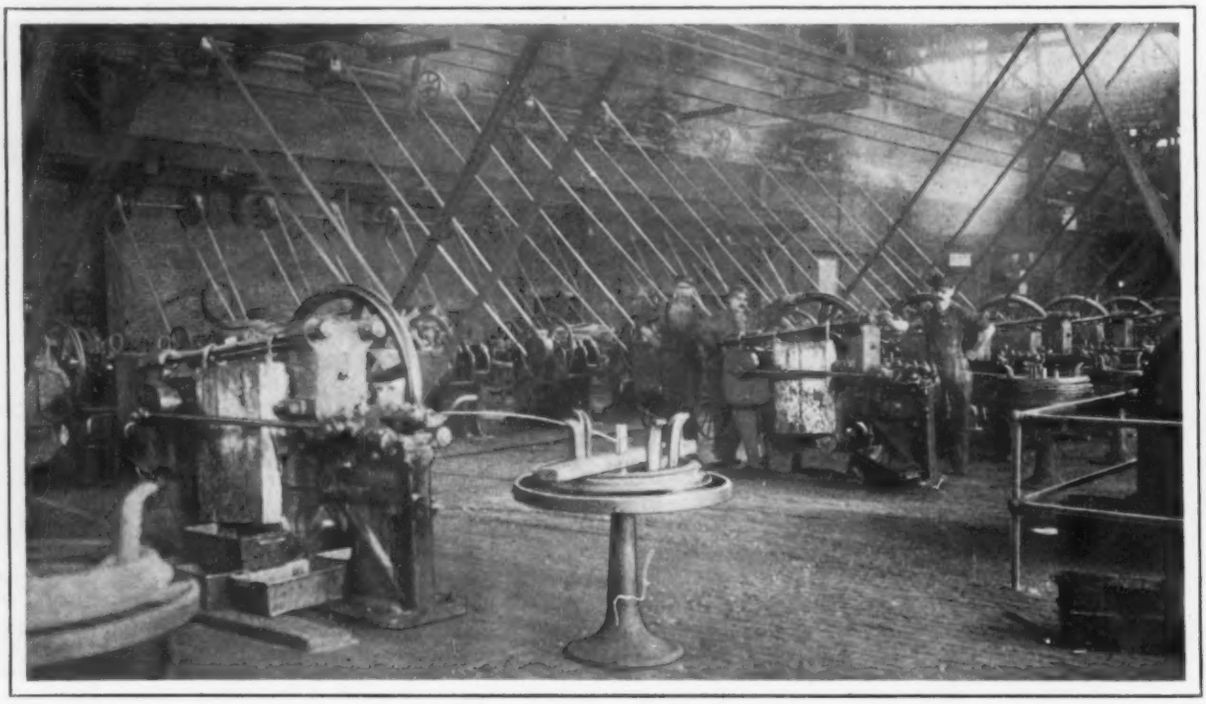


Cold Mills, Tin Plate Department, Aliquippa Works

SIDE GUIDE AND GRIPPER

Riter-Conley Mfg. Company and the other by the Jones & Laughlin Steel Company. Each furnace has a rated capacity of 500 tons per day. The blowing equipment consists of 10 Allis-Chalmers vertical steeple type cross compound condensing engines. The air cylinders are 84 in. diameter by 60 in. stroke; the high pressure steam cylinder 46 in. diameter, 60 in. stroke, and the low pressure steam cylinder 86 in. diameter, 60 in. stroke. The air tubes are fitted with the Reynolds induction and discharge valves and the steam cylinders with Reynolds releasing Corliss gear. The normal capacity of each of these units is 30,000 cu. ft. of free air per minute. The shipping weight of each is approximately 500 net tons.

The furnaces are charged by electric hoists. Ore is transferred from the railroad cars through a stationary car tipper to a transfer car having a capacity of 125,000 lb. From the car it is discharged into a pit running the full length of the ore yard. For the transfer of ore from this pit to the stockpile or to furnace bins two ore bridges of the man-trolley type are used, equipped with a grab bucket of 7½ tons capacity. The ore yard has a storage capacity of about 1,500,000 tons. The bins for storage of ore, coke and limestone are of the parabolic type and the top of the bins is on the yard level.



Wire Nail Department, Aliquippa Works

Steel Plant

For the production of steel there are provided one 20-ton Bessemer converter, one 400-ton metal reservoir, and four 250-ton Talbot tilting open-hearth furnaces. Metal from the converter and mixer is transferred to the open-hearth department by an electric locomotive, and is charged into the open-hearth furnaces by two electric cranes of 50 tons capacity. The charging machines for cold stock are of the low type. The gas for the furnaces is furnished by 30 Morgan continuous gas producers, equipped with the George mechanical feed. On the pouring side of the furnaces, the ladles are of 80 tons capacity and the cranes which convey them to the pouring platform have a capacity of 150 tons each. The standard ingots made are 22 x 24 in., weighing 8500 lb. They are stripped by an electric stripper mounted on a crane runway, running the full length of the open-hearth department. The estimated capacity is 50,000 tons of ingots per month.

The heating department is equipped with four soaking pit furnaces of four holes each. The ingots are charged and drawn by two overhead cranes and are delivered to the blooming mill table rolls by an electric motor car.

Blooming Mill

A 40-in. two high direct connected blooming mill is driven by a twin tandem compound condensing engine, 44 in. and 70 in. by 60 in., the total weight of the engine being 1050 net tons. Mill and engine were built by Mackintosh, Hemphill & Co. The mill has a range in sizes from 4 in. by 4 in. billets to 12 in. by 12 in. blooms, and slabs up to 36 in. in width. The manipulator is equipped with movable side guards and overhead lifting fingers. The slabs and large blooms for shipment are delivered to a hydraulic shear, having a shearing capacity of 225 sq. in. The blooms which are rolled direct into small billets or tin bars pass through an electric shear, having a shearing capacity of 100 sq. in.

Bar and Billet Mill

The blooms are delivered to a continuous mill consisting of four 21-in. and six 18-in. stands of rolls, driven by a 48-in. and 84-in. by 60-in. horizontal cross-compound condensing engine. The product of this mill is standard sheet and tin bars, also billets ranging in size from 1¾ in. up to 3 in. square. A steam flying shear cuts both the sheet bars and billets into 30-ft. lengths as they leave the last pass of the 18-in. mill. The bars run from this shear to the bar piler. When the latter holds the product of two ingots the bars are lifted from the piler and placed on the cooling beds until cool enough for loading into cars for shipment.

Tin Plate Department

The above description embraces the parts of the plant known as the North mills. Of the South the first to which reference will be made is the tin plate department, which consists of 24 hot mills driven by two 34 and 60 by 60-in. twin tandem direct connected engines. Each engine drives 12 mills, half on each side of the engine. There are 24 doubling shears and 26 squaring shears, all motor driven. The capacity of this department is 8000 tons of black plate per month. The black pickling and annealing department is equipped with three four-arm pickling machines, and five annealing furnaces. The black plate is delivered and taken from the annealing furnaces by two electric cranes.

The cold rolling department consists of three trains with 10 stands in each train, and driven by 30-in. and 60-in. by 60-in. cross-compound engines. The product of the cold rolls is delivered to the white annealing and white pickling department by the two cranes before mentioned. From the white pickler the plates are delivered to the tinning department by a crane. The tin house is equipped with 44 tinning stacks of the duplex type and 44 cleaning machines. This department has a capacity of 2,000,000 base boxes of tin plate per annum.

Wire Department

Active work on the wire department, which consists of two rod mills, wire nail machines, barb wire, plain wire and galvanizing equipment and other accessories, was begun in October, 1909, and the first wire was drawn on November 1, 1910. Of the rod mills, No. 1 is a right hand mill and No. 2 a left hand mill, each driven by a 34-in. and 64-in. by 54-in. cross-compound Corliss engine. The rod mills are of the continuous Morgan Construction Company type. The continuous heating furnaces are fired with gas from six producers with mechanical feed, and three producers are required for each furnace. The rods are coiled on patent reels, four of which are required for each mill, and the bundles are taken from the reels by an incline conveyor which in turn delivers them to the cooling conveyor extending the entire length of the rod shed. Rods intended for internal consumption are taken off at the point nearest the cleaning house, while rods for outside shipment remain on the conveyor until they have been cropped and prepared for shipment, and are then taken on trucks directly into the cars. The output of the two rod mills is about 800 tons a day, ranging in size from No. 5 to 7/16 in. The cleaning house, situated north of the rod mill, contains two pickling rings and two bakers.

The wire mill is equipped with annealing furnaces and 334 wire blocks, and its capacity is about 600 tons a day. The product is taken either to the galvanizing department or to the wire nail mill. There are five tube annealing furnaces, each with the necessary equipment of galvanizing pans and take-up frames. The product of this department goes largely into barbed wire and field fence. At the north end of the building is a frame for rewinding and painting, and to the east of this building and between it and the nail warehouse are located the loading platform and bundling department, where the product is prepared for shipment and the cars are loaded. East of this is a building which contains the wire nail department.

Wire Nail Department

The first wire nails were made on November 2, 1910. The annual capacity is 1,000,000 kegs. The building also contains the nail-cleaning department and the nail warehouse. East of it are the blacksmith shop, machine shop and tool room, belonging to the wire department, and north of the machine shop is located the South mills emergency hospital, which is provided for the employees of the wire and tin plate works. The hospital is fully equipped in every way, having the latest appliances for the care of injured employees. To the north is the cooperage building, in which is also located the carpenter shop for both the tin plate and wire mill departments.

Coke Works

The coke ovens now under construction consist of two batteries of the rectangular or Belgian type, with 120 ovens in each, the daily capacity being approximately 720 tons. As planned, the coke works will finally consist of 600 ovens. The coal is brought down the Ohio River from the company's mines in barges and unloaded by means of a bucket elevator system. A 48-in. belt conveyor delivers it either to the storage yard or to the coke ovens for direct consumption. The storage yard will be equipped with a bridge provided with belt conveyors for stocking and reclaiming the coal. Waste gases from the coke ovens will be used to generate steam for the wire and tin-plate departments.

Boiler Plants

Boiler plant No. 1 furnishes steam for the North works and consists of boiler houses Nos. 1, 2 and 3, numbered from north to south. There are 52 boilers in this plant, all of 400 hp.; giving a total boiler capacity of 20,800 hp. These are normally fired with blast-furnace gas, coal being used only for pilot fires. Some of the boilers have been equipped with herringbone grates, which permit the firing of coal to get the full capacity of the boilers in cases of emergency. The boiler feed pump house is situated about the center of the boiler plant, and is equipped with two Allis-Chalmers crank and flywheel pumping engines, and one De Laval, three-stage, centrifugal pump. Water for the boilers passes through two water softeners of the Kennicot type.

Boiler plant No. 2, located at the South mills, supplies steam to the rod, wire and tin plate mills. It consists of 18 400-hp. vertical boilers, arranged to be fired with coal. As soon as the coke ovens are completed these boilers will receive waste gases from the ovens. The water for these boilers also passes through a water softener.

The direct-current equipment in this department consists of two 1000-kw. direct-connected engine-driven and one 1000-kw. motor generator sets. The alternating-current equipment is composed of two 1000-kw. direct-connected engine-driven generators, two 3000 kw. and one 750 kw.

Pumping Station

The water supply is secured from the Ohio River and the central pumping station is approximately 3500 ft. from the North mills and 6000 ft. from the South mills. The pump house is a circular concrete structure 50 ft. in diameter, extending from elevation 650, which is 18 ft. below low-water level, to elevation 725, or 13 ft. above high water, with a circular brick superstructure 34 ft. high, inclosing the motors and control apparatus. An annular concrete wall supports the pump floor, and divides the bottom of the station into an outer annular and an inner circular well, each of which is connected by a separate tunnel to one of the two compartments of the intake pier, which is about 200 ft. out in the river. Each pump is equipped with two separate suction pipes, one in each well, whereby the entire supply can be drawn from either well while the other is being cleaned or repaired. The pumps are vertical shaft centrifugal type two-stage with 20-in. suction and 18-in. discharge pipe, and are designed to deliver 12,000,000 gal. per day against a head of 200 ft. The station is designed for eight of these pumps, or a total capacity of 96,000,000 gal. per day.

The service water to South mills is furnished by discharge from the blooming mill, billet and bar mill and power house condenser, which is collected in a basin at the bar mill and flows by gravity through a 48-in. reinforced concrete line to a basin at the South mills. There is also a connection to this gravity line from the central pump station, so that fresh water may be turned into the line whenever necessary. The water at the South mills is repumped by three motor-driven centrifugal pumps, each of 10,000,000 gal. capacity. These pumps discharge into an 18-in. main, from which a branch leads to a standpipe 18 in. in diameter and 80 ft. high. From this line mains lead to all points in the tin-plate and wire departments where water is required.

Inland Steel Company's Expansion

The following is a general news item issued at Chicago: "The First Trust Company will offer, at 102, $1,000,000 Inland Steel 6 per cent. bonds recently purchased. It offered an initial issue of $1,500,000 last July, at par. The total authorized issue is $10,000,000, but none of the remaining $7,500,000 will be sold for over a year, at least. The company's expenditures on extensions and improvements, this year and next, will aggregate $4,000,000, which is covered by the sale of $2,500,000 bonds, and the previous sale of new stock. Its gross earnings in the current half of 1912 are 25 per cent. over a year ago, and the net earnings increased more than 25 per cent. The next six months should show greater increases, because prices have advanced. Commencing next month, the company's rolling mills have specifications enough to run full time on bars and structural shapes until June, and orders on the books will keep all departments running fully until September. The capacity will increase materially next spring. The stock is quoted around 220, or forty points above last June's level, and near the high record."

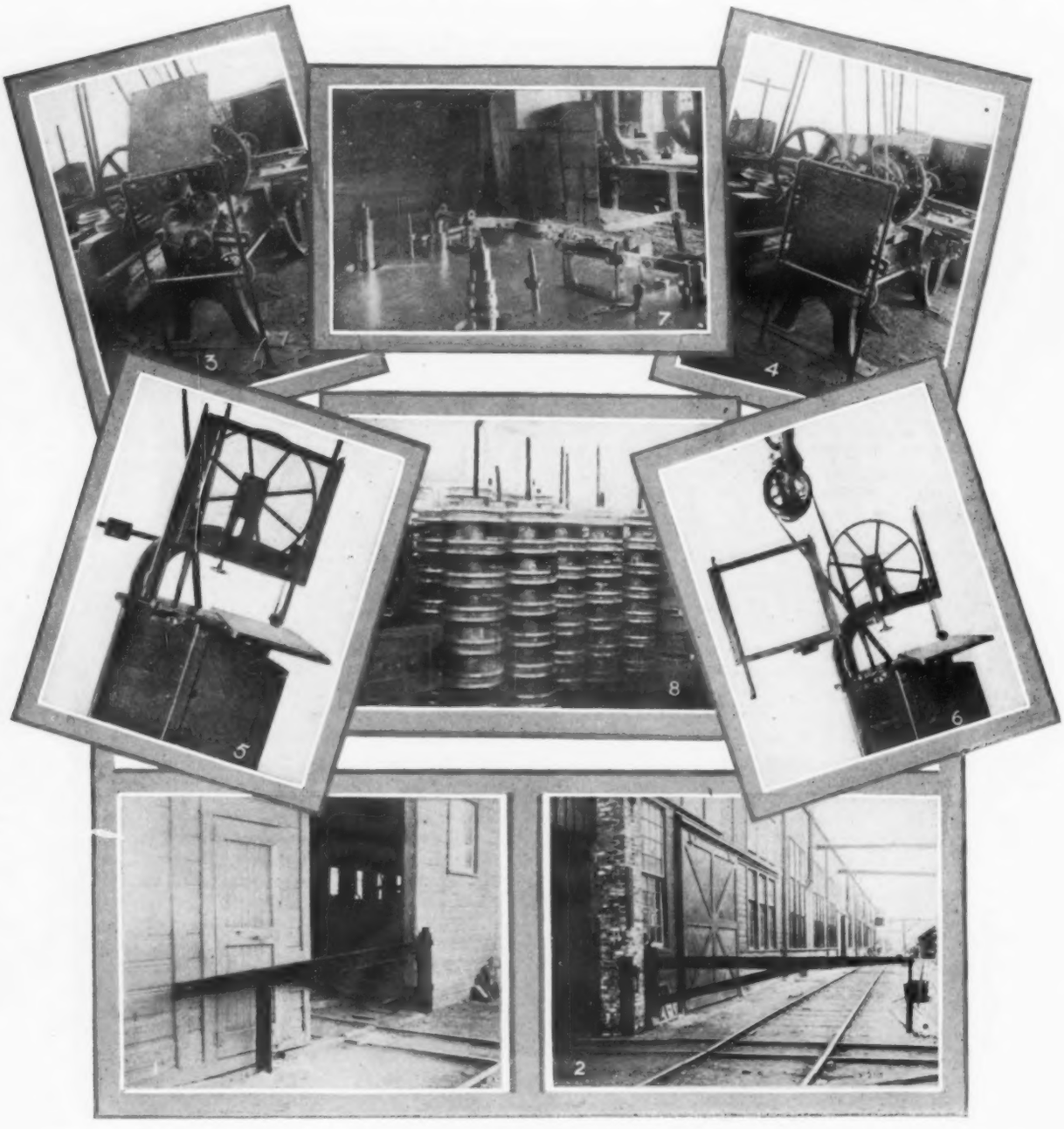
Two speedometer manufacturing companies—the Warner Instrument Company, Beloit, Wis., and the Stewart & Clark Mfg. Company, Chicago—will consolidate as the Stewart-Warner Speedometer Corporation, which is to be capitalized at $11,000,000, of which $10,000,000 will be common stock, and $1,000,000 7 per cent. cumulative preferred, redeemable at 110. J. K. Stewart will head the new corporation, and C. B. Smith will be secretary and treasurer. The organization and management of the plants will remain as heretofore, and the product of each factory will be handled separately.

Devices to Make Shop Operations Safer

Educational and Preventive Work Under the Auspices of the National Metal Trades Association

Important progress has been made in the past year in the movement for industrial safety that was inaugurated by the National Metal Trades Association. The association is carrying on an active campaign of education in order to arouse interest in safety devices among plant managers and employees. Its official safety inspector, William H. Doolittle, not only visits plants of the members, making thorough investigation, observing places where accidents are likely to happen and making suggestions for their safeguarding, as well as instructing foremen and workmen how to make and use the guards, but also in the various cities he visits delivers addresses illustrated with stereopticon views. These meetings are attended by employers, superintendents, heads of departments, foremen and workmen, and have been very well received.

Some of the recent photographs of safety devices taken by Mr. Doolittle are shown in the accompanying illustrations. Attention is called to the fact that all these appliances are home made. They are simple and effective devices for the purpose for which they are designed. They can be constructed and installed by workmen of average ability in any industrial plant. Safety gates at the plant of the Bucyrus Company, South Milwaukee, Wis., are shown in Figs. 1 and 2. The purpose of this device is to prevent workmen from stepping on the railroad track when trains, cars or engines are passing. Many workmen have been killed in this way and this simple device prevents such casualties. The gate in the left hand picture



ILLUSTRATIONS OF METHODS OF SECURING SAFETY IN INDUSTRIAL PLANTS

Figs. 1 and 2 Show Safety Gates at the Plant of the Bucyrus Company, South Milwaukee, Wis. Figs. 3 and 4 Show Method of Guarding Change Gears at the Works of William Sellers & Co., Philadelphia. Figs. 5 and 6 Show How a Band Saw is Guarded at the Plant of the United Engineering & Foundry Company, Pittsburgh. Fig. 7 Shows a Method to Make a Wood Shaper Safe at the Plant of the Manitowoc Seating Company, Manitowoc, Wis. Fig. 8 Indicates How Products in Process of Manufacture Are Piled to Prevent Falling

is over the door, warning the men not to step on the track, as it is in use. In the right-hand view the gate is shown covering the railroad track and giving notice to the trainmen that cars must not be moved until the gate is swung back over the door.

Guards for Change Gears and Band Saws

How the change gears of an engine lathe may be effectively guarded is shown in Figs. 3 and 4. The photographs were taken in the plant of William Sellers & Co., Inc., Philadelphia. The guard is constructed of iron pipe tees, elbows and flanges, with swinging apron of sheet steel. In the left-hand view the guard is shown swung up so that the lathe gears may be changed or adjusted. It is evident that when the guard is in this position it interferes with the running of the lathe so that the workman is compelled to return it to a safe position, as shown in the right-hand view.

An effective way of guarding a band saw is shown in Figs. 5 and 6. This guard is in use in the pattern shop of the Frank-Kneeland department of the United Engineering & Foundry Company, Pittsburgh. It completely covers all of the dangerous parts of the saw. The upper and lower wheels and the unused part between them are carefully enclosed. The upper part of the guard consists of a swinging gate made of wood and wire netting. The gate carries a slide, also made of wood, which covers the exposed part of the blade nearest the workman's hand. The simplicity and effectiveness of this guard will appeal to every patternmaker who wishes to be protected from injury.

How the dangerous wood shaper would be made safe is shown in Fig. 7. This photograph was taken in the plant of the Manitowoc Seating Company, Manitowoc, Wis. The device consists of a cylinder or safety head for the wood shaper made on the same principle as the one that has been successfully applied to the jointer or buzz planer. The safety heads are made of a shape corresponding to the required finished shape of the work to be done and are bored at the proper sizes to allow them to be slipped over the end of the shaper spindle. There is also a guard which surrounds the head and prevents contact with workmen's hands.

The way adopted by the Bucyrus Company, South Milwaukee, Wis., to keep piled work from falling is illustrated in Fig. 8. A number of sheave wheels are shown piled hub to hub one above another. Through the bored holes in the center of the sheaves a piece of iron pipe runs which fits in a hole in the floor, thus insuring safety.

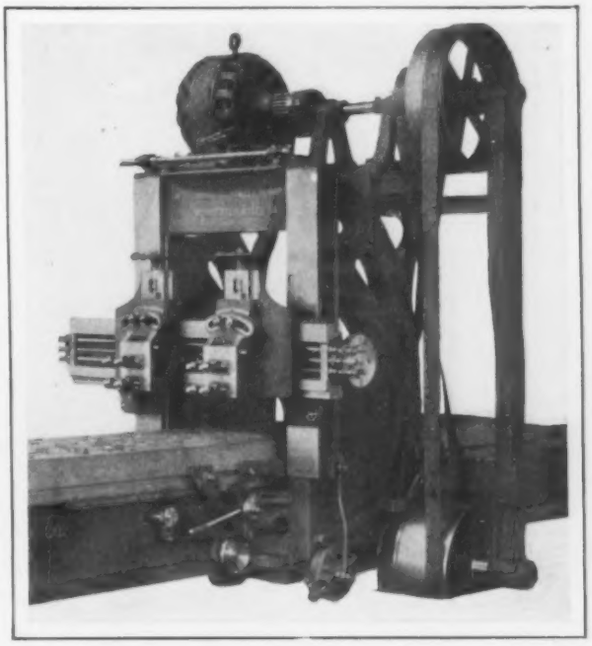
Some of the Late Addresses

Addresses on the subject of safety have recently been delivered by Safety Inspector Doolittle in Chicago and Cleveland before the superintendents' and foremen's clubs of the National Metal Trades Association branches in those cities; also in Cincinnati, in Indianapolis, where a meeting was held under the auspices of the Indianapolis branch of the National Metal Trades Association, and in Ensley and Bessemer, Ala., for the benefit of employees of the Tennessee Coal, Iron & Railroad Company. Other addresses have been delivered before the National Conservation Congress, Indianapolis, and the Co-operative Safety Congress, Milwaukee. The meeting in Indianapolis under the auspices of the Indianapolis branch of the association was arranged for and given publicity by A. J. Allen, secretary of the branch. His efforts to bring to the attention of the Indianapolis workmen some of the practical ways in which they may avoid accidents was met with a ready response on the part of the men. An important feature of the various meetings is the exhibit of photographs of safety devices and warning placards. The association has applications from many sources for safety addresses and an extensive tour is being arranged by the inspector for the next few months.

According to the decree of the referee in bankruptcy the properties of the Southern Iron & Steel Company, Birmingham, Ala., will be sold at public auction at Birmingham January 31, 1913. It is expected that they will be bid in by representatives of the reorganization committee, which holds the greater part of the company's bonds.

A New Frog and Switch Planing Machine

The Woodward & Powell Planer Company, Worcester, Mass., has brought out a new model frog and switch planing machine, which the illustration shows in the motor-driven type. With the belt drive the housings are low, with only sufficient distance above the table to permit of 17 in. under the cross rail. With the motor equipment the housings are carried up to the full dimensions of a 36 x 36-in. machine, to provide rigid support for the motor and countershaft. Hight is necessary, as it is desired to have ample length of belt, the theory being that a short belt must be so tight as to make difficult shifting on the pulleys. The bracket which supports the motor table is cast



The Woodward & Powell New Type Frog and Switch Planing Machine

on the column. Between the countershaft and the main driving shaft is a column which insures rigidity, preventing possible spring and the resultant loosening of the belt.

The machine is of rigid construction throughout, for the duty of a frog and switch planing machine is of the heaviest, and seldom is it operated by highly skilled men. The shafts and pinions are forged as units from high carbon steel, the table rack is of hammered steel, and the large gears of cast steel. All shafts run in removable bronze bushings, and the boxes, all of which are self-oiling, are long and the shafts of large diameter. The table is heavy and is gibbed to the bed. Each table track has two oil reservoirs which automatically distribute the lubricant to the ways by the action of the table. The machine, with the standard length of bed of 15 ft., and with two heads, weighs 39,000 lb.

Stock for Steel Workers

United States Steel Corporation employees, when they receive their annual invitation to subscribe to the company's stock this month under the profit-sharing plan, will find the price fixed at $66 a share for the common stock and $109 a share for the preferred. This is $1 a share less for the preferred and $1 a share more for the common than the prices at which some 36,946 employees took their pro rata allotments of the two issues in January, 1912, when 30,619 shares of preferred and 30,735 shares of the common stock were taken under the profit-sharing plan, which permits them to make gradual payments.

The fortnightly bulletin of the American Railway Association, as made up December 14, shows a further very slight decrease in the car shortage. On that day the net shortage on all the lines in this country and Canada was 34,392, a shrinkage of 2000 cars from the two weeks between this and the preceding statement. The report compiled November 30 showed a decreas of narly 15,000 cars.

Iron and Steel Prices for Fifteen Years

Monthly Averages Computed from the Weekly Market Quotations of "The Iron Age" in the Period 1898-1912

(With Supplement)

Accompanying this issue of *The Iron Age* is our annual chart, in which lines are plotted to indicate the course of prices for pig iron, Bessemer steel billets and some leading forms of finished iron and steel in the 15 years ending with 1912. The diagrams are based on monthly averages of prices quoted week by week in our market reports from the leading selling centers. The table below, which gives the monthly average prices on which the chart is based, includes also the price of No. 2 X foundry pig iron at Philadelphia, not plotted.

Bessemer Pig Iron at Pittsburgh, per Gross Ton (2240 lb.)

	1898	1899	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912
January	$9.87	$10.87	$24.99	$13.15	$16.70	$22.15	$13.91	$16.85	$18.35	$23.15	$19.00	$17.34	$19.90	$15.90	$15.05
February	10.05	11.60	24.80	14.43	16.93	21.45	13.66	16.41	18.35	22.85	17.90	16.78	19.34	15.90	14.90
March	10.39	14.59	24.72	16.31	17.37	21.85	14.25	16.35	18.28	22.85	17.86	16.25	18.60	15.90	15.09
April	10.41	15.03	24.70	16.75	18.75	21.28	14.18	16.35	18.19	23.35	17.49	15.78	18.27	15.90	15.15
May	10.30	16.20	21.00	16.30	20.75	20.01	13.60	16.16	18.10	24.01	16.93	15.84	17.52	15.90	15.13
June	10.34	18.51	19.72	16.00	21.56	19.72	12.81	16.65	18.23	24.27	16.90	16.05	16.60	15.90	15.15
July	10.25	20.65	16.75	16.00	21.60	18.89	12.40	14.85	18.41	23.55	16.83	16.46	16.40	15.90	15.20
August	10.35	21.75	15.60	15.75	21.62	18.35	12.81	15.20	19.00	22.90	16.23	17.03	16.09	15.90	15.46
September	10.78	23.43	13.87	15.75	21.75	17.22	12.63	15.91	19.54	22.90	15.90	18.05	15.90	15.90	16.15
October	10.36	24.18	13.06	15.89	21.75	16.05	13.10	16.54	20.35	22.00	15.71	19.53	15.90	15.44	17.80
November	10.15	24.78	13.48	16.00	21.68	15.18	14.85	17.85	22.85	20.65	16.59	19.90	15.82	15.00	18.02
December	10.58	24.90	13.43	16.31	21.75	14.40	16.65	18.35	23.75	19.34	17.40	19.90	15.90	15.03	18.15

Bessemer Steel Billets at Pittsburgh, per Gross Ton

January	14.93	16.62	34.50	19.75	27.50	29.60	23.00	22.75	26.25	29.40	28.00	25.00	27.50	23.00	20.00
February	15.06	18.00	34.87	20.31	29.37	29.87	23.00	23.50	26.50	29.50	28.00	25.00	27.50	23.00	20.00
March	15.25	24.30	33.00	22.88	31.25	30.62	23.00	24.00	26.70	29.00	28.00	23.00	27.50	23.00	19.75
April	15.06	25.37	32.00	24.00	31.50	30.25	23.00	24.00	27.00	30.12	28.00	23.00	26.75	23.00	20.00
May	14.85	26.75	28.90	24.00	32.20	30.37	23.00	23.50	26.40	30.30	28.00	23.00	26.12	22.60	20.80
June	14.65	30.10	27.25	24.38	32.37	28.87	23.00	22.00	26.63	29.62	25.75	23.00	25.30	21.00	20.87
July	14.50	33.12	21.00	24.00	31.75	27.60	23.00	22.00	27.25	30.00	25.00	23.50	25.00	21.00	21.50
August	15.85	35.40	18.20	24.20	31.06	27.00	23.00	24.00	27.80	29.25	25.00	24.13	24.62	21.00	22.12
September	16.00	38.37	16.93	24.88	29.50	27.00	20.00	25.00	28.00	29.37	25.00	25.00	24.40	20.75	23.62
October	15.56	38.75	16.50	26.70	29.70	27.00	19.50	25.62	28.00	28.20	25.00	26.25	23.75	20.00	26.00
November	15.06	36.50	18.95	27.00	28.50	24.00	20.25	26.00	28.88	28.00	25.00	27.13	23.30	19.50	27.00
December	15.80	33.75	19.75	27.50	29.12	23.00	21.20	26.00	29.50	28.00	25.00	27.50	23.00	19.25	27.00

Basic Pig Iron, f.o.b. Mahoning or Shenango Valley Furnace; per Gross Ton

January	....	....	....	....	....	....	....	15.46	17.06	21.90	16.90	15.50	16.87	13.25	12.35
February	....	....	....	....	....	....	....	15.25	16.82	22.00	15.97	15.12	16.31	13.65	12.25
March	....	....	....	....	....	....	....	15.55	16.85	21.50	15.62	14.94	16.00	13.75	12.81
April	....	....	....	....	....	....	....	15.06	16.88	21.50	15.25	14.05	15.94	13.75	13.00
May	....	....	....	....	....	....	....	15.06	17.00	22.90	14.91	14.12	15.19	13.32	13.00
June	....	....	....	....	....	....	11.76	14.60	16.94	22.40	15.25	14.62	14.70	13.05	13.12
July	....	....	....	....	....	....	11.20	14.00	17.12	21.75	14.51	15.05	14.50	13.12	13.40
August	....	....	....	....	....	....	11.69	14.32	17.70	21.25	14.69	15.25	14.12	13.00	13.94
September	....	....	....	....	....	....	11.60	14.86	18.44	20.06	14.43	15.90	13.70	12.80	14.37
October	....	....	....	....	....	....	12.19	15.25	19.55	19.50	14.04	16.94	13.15	12.52	15.98
November	....	....	....	....	....	....	14.00	16.87	21.37	18.12	14.72	17.25	13.25	12.42	16.37
December	....	....	....	....	....	....	15.70	16.75	21.50	17.50	15.60	17.05	13.40	12.25	16.50

Southern No. 2 Foundry Pig Iron at Cincinnati, per Gross Ton

January	9.50	10.31	20.69	13.45	14.55	21.65	12.37	16.25	16.75	26.00	16.15	16.25	17.25	14.25	13.25
February	9.25	11.69	20.50	13.12	14.75	21.50	12.12	16.25	16.75	26.00	15.75	16.13	17.06	14.25	13.31
March	9.25	13.75	20.30	14.00	14.75	21.37	12.10	16.25	16.65	26.00	15.50	15.05	16.30	14.25	13.50
April	9.25	14.50	20.19	14.50	16.87	20.15	12.50	16.25	16.63	25.06	15.20	14.25	15.37	14.25	13.75
May	9.37	14.56	19.75	13.85	18.35	18.87	12.25	15.81	16.75	24.25	14.75	14.50	15.00	13.95	14.15
June	9.30	16.00	18.75	13.37	20.19	17.75	11.80	14.65	16.44	24.10	15.25	14.70	14.85	13.44	14.25
July	9.25	17.56	16.81	13.00	20.75	16.15	11.81	13.94	16.06	23.85	15.00	15.75	14.75	13.25	14.70
August	9.37	18.35	14.25	13.00	23.06	15.19	12.00	14.40	17.30	23.00	15.25	16.38	14.31	13.45	15.06
September	9.55	19.94	13.62	13.06	25.00	14.75	12.00	14.37	18.69	21.50	15.65	17.35	14.25	13.31	15.87
October	9.75	20.75	12.87	13.75	25.65	13.50	12.81	15.31	20.00	20.95	15.75	17.88	14.25	13.25	16.80
November	9.75	20.75	12.95	14.00	23.62	12.00	15.19	16.60	23.38	19.50	16.00	17.75	14.25	13.20	17.25
December	9.90	20.75	13.75	14.25	22.44	12.05	15.85	16.75	25.00	17.00	16.25	17.45	14.25	13.19	17.25

Local No. 2 Foundry Pig Iron at Chicago (at Furnace), per Gross Ton

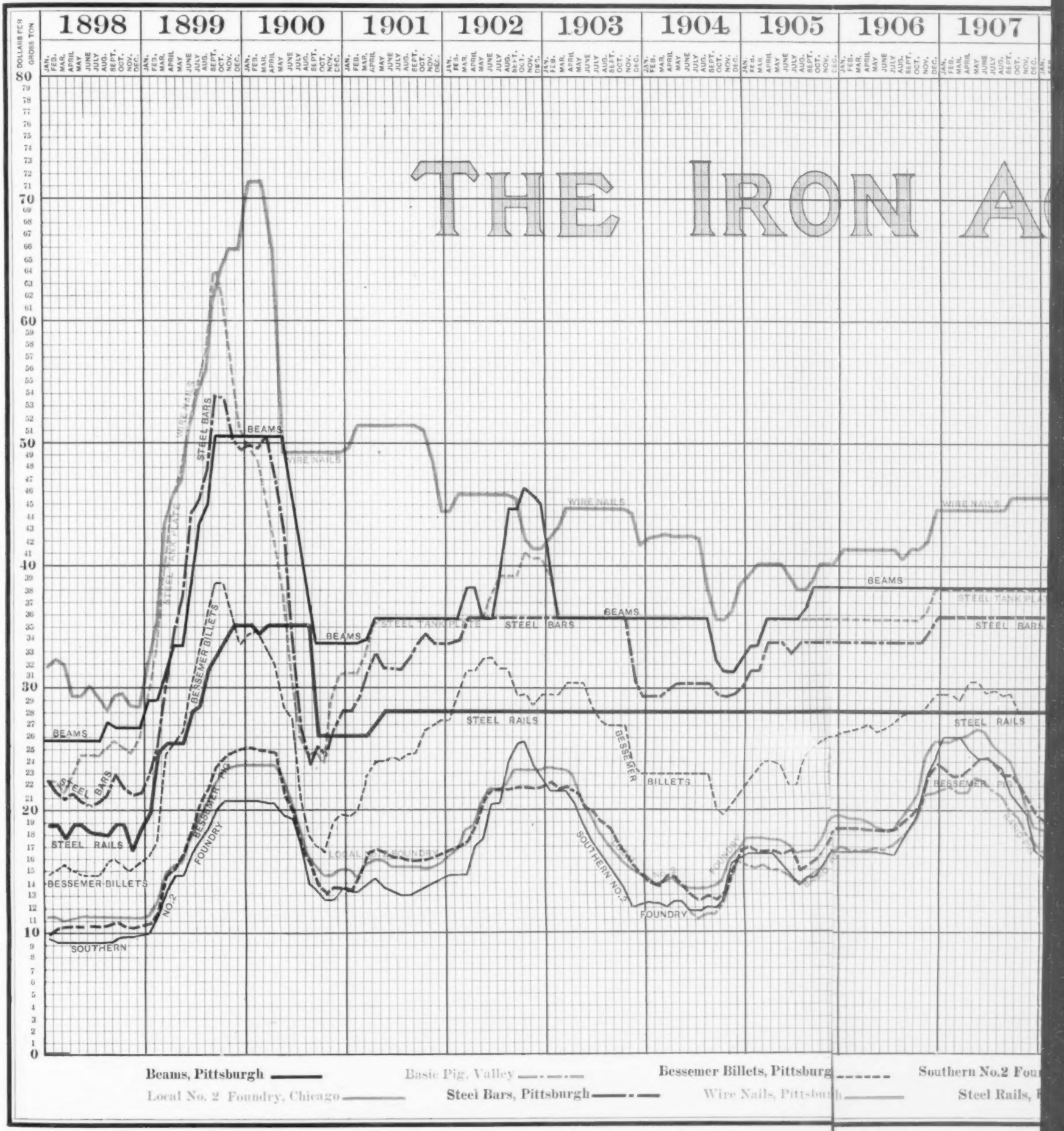
January	11.35	11.47	23.85	15.10	16.25	23.45	14.47	17.85	19.60	25.85	18.45	17.35	19.00	15.50	14.00
February	11.28	12.47	23.85	14.60	16.85	23.35	13.91	17.85	19.41	25.85	18.16	16.75	19.00	15.50	14.00
March	11.10	14.95	23.85	15.60	18.51	23.22	14.05	17.80	19.35	26.10	17.85	16.50	18.30	15.50	14.00
April	11.26	15.47	23.72	15.85	18.97	22.87	14.35	17.60	19.10	26.35	17.73	16.50	17.50	15.00	14.00
May	11.35	15.72	22.65	15.85	20.85	20.72	13.85	17.60	18.90	26.85	17.63	16.50	17.06	15.00	14.50
June	11.35	17.95	20.72	15.35	21.85	19.85	13.70	17.00	18.54	26.60	17.73	16.50	16.75	15.00	14.50
July	11.35	19.22	18.60	15.35	21.60	18.25	13.60	16.47	18.60	25.55	17.55	17.00	16.56	14.87	14.70
August	11.35	20.65	16.25	15.35	22.10	17.22	13.60	16.60	19.45	24.85	17.35	17.13	16.50	14.50	15.37
September	11.35	22.22	15.35	15.35	23.35	16.41	13.85	16.60	20.16	24.10	17.05	18.70	16.40	14.50	16.00
October	11.35	23.35	14.85	15.10	23.35	15.70	14.10	17.66	21.48	22.45	16.85	19.00	16.06	14.46	17.00
November	11.35	23.45	14.85	15.23	23.35	15.10	15.98	19.15	24.70	20.66	17.10	19.00	16.00	14.09	17.75
December	11.35	23.85	15.10	15.85	23.35	14.81	16.95	19.60	25.85	18.80	17.35	19.00	16.00	14.00	18.00

Standard Brands Eastern Pennsylvania No. 2 X Foundry Pig Iron at Philadelphia, per Gross Ton

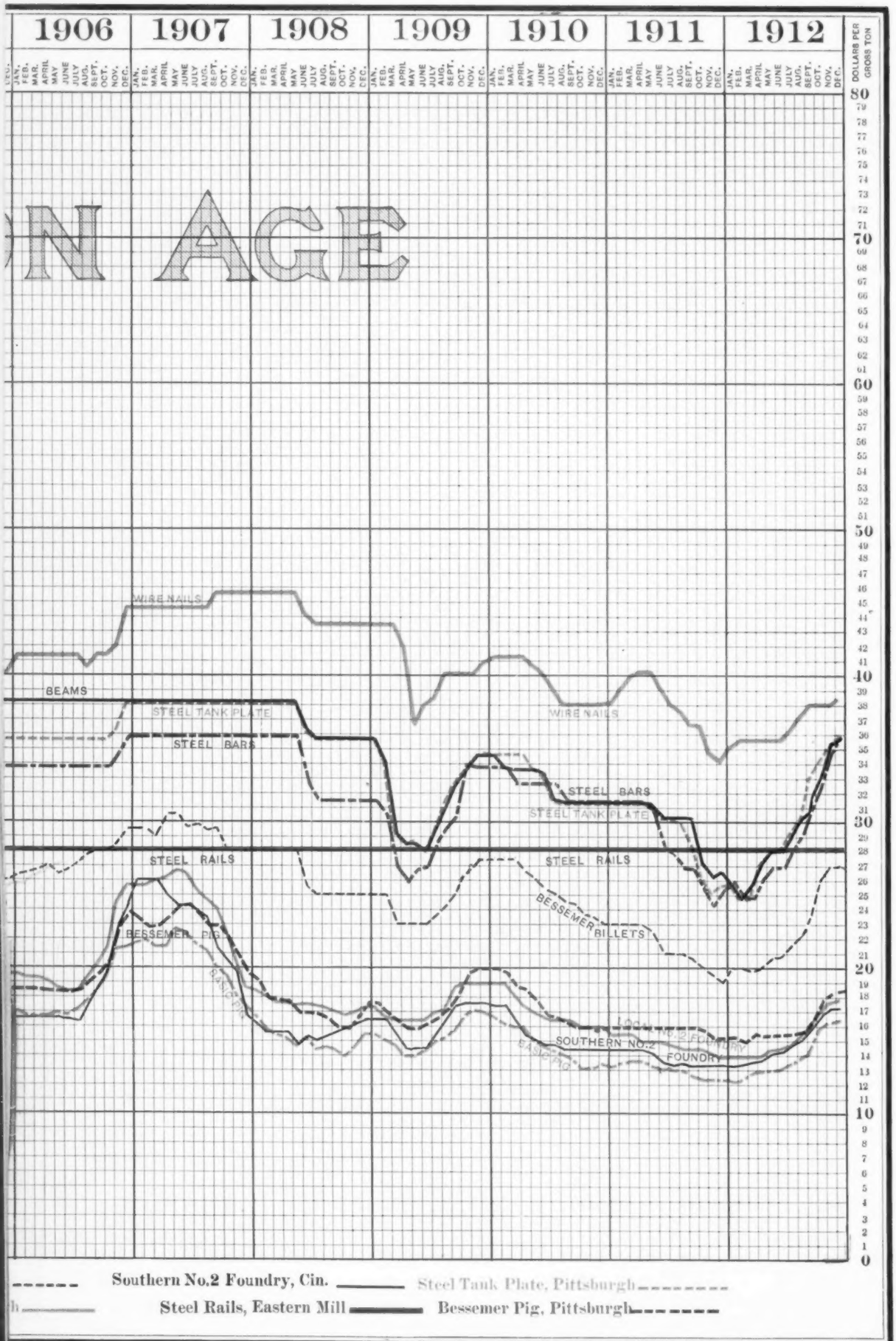
January	10.87	11.44	22.70	15.50	16.75	22.45	14.69	17.50	18.50	24.80	18.25	17.25	19.00	15.50	14.85
February	10.75	11.06	22.56	15.31	17.19	22.25	14.50	17.50	18.50	25.87	18.25	17.00	18.69	15.50	14.85
March	10.55	14.70	22.31	15.12	18.81	22.25	14.80	17.56	18.35	25.00	18.12	16.37	18.00	15.50	14.92½
April	10.50	15.75	21.75	15.46	19.62	21.87	15.00	17.75	18.44	24.81	17.65	16.20	17.75	15.50	15.00
May	10.50	15.81	20.60	15.19	19.75	20.06	14.75	17.81	18.50	25.55	16.94	16.06	17.00	15.50	15.18
June	10.50	17.25	18.75	15.06	20.94	19.19	14.50	16.75	18.44	24.62	16.62	16.42	16.55	15.25	15.31¼
July	10.00	19.44	16.37	15.00	22.30	18.10	14.31	16.12	18.25	23.06	16.50	16.50	16.25	15.00	15.70
August	10.30	20.65	16.15	14.97	22.00	16.87	14.25	16.25	19.00	21.90	16.50	17.00	16.00	15.00	15.87½
September	10.75	22.75	15.56	14.80	22.00	16.12	14.25	16.43	20.44	20.50	16.62	18.05	16.00	15.00	16.58¾
October	10.75	22.75	15.00	15.25	22.12	15.20	14.43	17.25	21.12	19.85	16.75	18.69	15.81	15.00	17.60
November	10.87	23.40	15.35	15.37	23.37	15.00	15.75	18.05	23.30	18.94	17.00	19.00	15.68	14.95	18.25
December	11.06	23.25	15.62	15.75	23.00	15.00	16.90	18.25	24.00	18.84	17.25	19.00	15.50	14.85	18.25

Soft Steel Bars at Pittsburgh, in Cents per Pound

January	0.98¾	1.02½	2.22½	1.25	1.50	1.60	1.30	1.40	1.50	1.60	1.60	1.40	1.50	1.40	1.15
February	0.95	1.12½	2.21¼	1.30	1.51¼	1.60	1.30	1.40	1.50	1.60	1.60	1.35	1.50	1.40	1.12½
March	0.93½	1.36	2.25	1.40	1.60	1.60	1.33	1.50	1.50	1.60	1.60	1.20	1.45	1.40	1.10
April	0.95	1.56¼	2.10	1.47½	1.60	1.60	1.35	1.50	1.50	1.60	1.60	1.15	1.45	1.40	1.16
May	0.92½	1.67½	1.91	1.41	1.60	1.60	1.35	1.50	1.50	1.60	1.60	1.18¾	1.45	1.37	1.20
June	0.90	1.98	1.52½	1.40	1.60	1.60	1.35	1.46	1.50	1.60	1.45	1.20	1.45	1.25	1.20
July	0.91¼	2.02½	1.18¾	1.40	1.60	1.60	1.35	1.50	1.50	1.60	1.40	1.27	1.45	1.23½	1.25
August	0.93¾	2.14	1.05	1.44	1.60	1.60	1.35	1.50	1.50	1.60	1.40	1.32½	1.40	1.20	1.30
September	1.02	2.40	1.12½	1.50	1.60	1.60	1.31	1.50	1.50	1.60	1.40	1.39	1.40	1.18¾	1.37
October	0.97	2.38¾	1.08¾	1.53	1.60	1.60	1.30	1.50	1.50	1.60	1.40	1.51¼	1.40	1.12½	1.45
November	0.94	2.24	1.18	1.50	1.60	1.37½	1.31¼	1.50	1.54	1.60	1.40	1.50	1.40	1.08	1.55
December	0.95	2.20	1.25	1.50	1.60	1.30	1.34	1.50	1.60	1.60	1.40	1.50	1.40	1.12½	1.60



Fluctuations in the Prices of Crude and Finished Iron a
to January 1, 1913—Gross Ton



hed Iron and Steel from January 1, 1898, —Gross Tons

Tank Plates at Pittsburgh, in Cents per Pound

	1898	1899	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912
January	1.00	1.30	2.22½	1.40	1.60	1.75	1.60	1.50	1.60	1.70	1.70	1.60	1.55	1.40	1.15
February	1.00	1.47½	2.17½	1.40	1.60	1.60	1.60	1.50	1.60	1.70	1.70	1.52½	1.55	1.40	1.11¼
March	0.97½	1.75	2.03	1.47½	1.60	1.60	1.60	1.60	1.60	1.70	1.70	1.30	1.55	1.40	1.12½
April	1.02½	2.05	1.87½	1.57½	1.60	1.60	1.60	1.60	1.60	1.70	1.70	1.27½	1.55	1.40	1.21¼
May	1.10	2.12½	1.69	1.60	1.60	1.60	1.60	1.60	1.60	1.70	1.70	1.28¾	1.51¼	1.39	1.25
June	1.10	2.32	1.38¾	1.60	1.68¾	1.60	1.60	1.60	1.60	1.70	1.62½	1.25	1.48	1.35	1.25
July	1.08¾	2.45	1.16¼	1.60	1.75	1.60	1.60	1.60	1.60	1.70	1.60	1.33	1.41¼	1.35	1.30
August	1.11⅜	2.55	1.09	1.60	1.75	1.60	1.60	1.60	1.60	1.70	1.60	1.40	1.40	1.34	1.35
September	1.15	2.85	1.11¼	1.60	1.75	1.60	1.44	1.60	1.60	1.70	1.60	1.46	1.40	1.28¾	1.47
October	1.12½	2.78¾	1.07½	1.60	1.84	1.60	1.40	1.60	1.60	1.70	1.60	1.50	1.40	1.17½	1.53
November	1.11½	2.52	1.31	1.60	1.82½	1.60	1.40	1.60	1.62½	1.70	1.60	1.53¾	1.40	1.13	1.59
December	1.16	2.30	1.38¾	1.60	1.82½	1.60	1.45	1.60	1.70	1.70	1.60	1.55	1.40	1.15	1.60

Beams at Pittsburgh, in Cents per Pound

January	1.15	1.30	2.25	1.50	1.60	1.80	1.60	1.50	1.70	1.70	1.70	1.60	1.55	1.40	1.15
February	1.15	1.30	2.25	1.50	1.60	1.60	1.60	1.50	1.70	1.70	1.70	1.52½	1.51¼	1.40	1.11¼
March	1.15	1.40	2.25	1.52½	1.70	1.60	1.60	1.60	1.70	1.70	1.70	1.30	1.50	1.40	1.15
April	1.15	1.50	2.25	1.60	1.70	1.60	1.60	1.60	1.70	1.70	1.70	1.27½	1.50	1.40	1.21¼
May	1.15	1.50	2.25	1.60	1.60	1.60	1.60	1.60	1.70	1.70	1.70	1.27½	1.50	1.39	1.25
June	1.15	1.70	2.07½	1.60	1.60	1.60	1.60	1.60	1.70	1.70	1.62½	1.25	1.48	1.35	1.25
July	1.15	1.93¾	1.90	1.60	1.84	1.60	1.60	1.60	1.70	1.70	1.60	1.33	1.41¼	1.35	1.30
August	1.21¼	2.05	1.74	1.60	2.00	1.60	1.60	1.63	1.70	1.70	1.60	1.40	1.40	1.35	1.35
September	1.20	2.25	1.50	1.60	2.00	1.60	1.44	1.70	1.70	1.70	1.60	1.46	1.40	1.33¾	1.42
October	1.20	2.25	1.50	1.60	2.07	1.60	1.40	1.70	1.70	1.70	1.60	1.50	1.40	1.21¼	1.48
November	1.20	2.25	1.50	1.60	2.05	1.60	1.40	1.70	1.70	1.70	1.60	1.53¾	1.40	1.13	1.57
December	1.20	2.25	1.50	1.60	2.00	1.60	1.44	1.70	1.70	1.70	1.60	1.55	1.40	1.15	1.60

Wire Nails at Pittsburgh, per Keg of 100 lb.

January	$1.42	$1.43	$3.20	$2.22	$1.99	$1.89	$1.89	$1.75	$1.85	$2.00	$2.05	$1.95	$1.85	$1.71¼	$1.57
February	1.45	1.57	3.20	2.30	2.05	1.92	1.90	1.80	1.85	2.00	2.05	1.95	1.85	1.75	1.60
March	1.43	1.94	3.20	2.30	2.05	2.00	1.91	1.80	1.85	2.00	2.05	1.95	1.85	1.79	1.60
April	1.31	2.05	2.95	2.30	2.05	2.00	1.90	1.80	1.85	2.00	2.05	1.87	1.85	1.80	1.60
May	1.31	2.10	2.20	2.30	2.05	2.00	1.90	1.80	1.85	2.00	2.05	1.65	1.82	1.80	1.60
June	1.35	2.30	2.20	2.30	2.05	2.00	1.90	1.74	1.85	2.00	1.97	1.70	1.80	1.75	1.60
July	1.31	2.42	2.20	2.30	2.05	2.00	1.89	1.70	1.84	2.00	1.95	1.72	1.75	1.70	1.62
August	1.26	2.50	2.20	2.30	2.05	2.00	1.71	1.70	1.82	2.00	1.95	1.80	1.70	1.69	1.66¼
September	1.32	2.76	2.20	2.30	2.03	2.00	1.60	1.74	1.86	2.05	1.95	1.80	1.70	1.65	1.70
October	1.33	2.87	2.20	2.28	1.89	2.00	1.60	1.80	1.85	2.05	1.95	1.80	1.70	1.63¾	1.70
November	1.28	2.95	2.20	2.17	1.85	1.97	1.62	1.80	1.88	2.05	1.95	1.80	1.70	1.55	1.70
December	1.27	2.95	2.20	1.99	1.85	1.87	1.73	1.80	2.00	2.05	1.95	1.85	1.70	1.53¼	1.72½

In plotting the lines, those representing finished material have been derived by multiplying the market prices of finished material per pound by 2240, so that the traversing lines would show the exact price relation between gross tons of all products. In the preceding tables, however, while pig iron and steel billet prices are in dollars per gross ton, those for finished material are stated in the usual way—namely, in cents per pound.

The period covered has been a most eventful one in the American iron trade. It begins with 1898, the year in which the depression following the panic of 1893 reached its culmination in its disastrous effect upon iron and steel prices. In 1899 came rapid advances, as demand matured which the capacity of the country was inadequate to supply. The remarkable peak of that year is the spectacular feature of the chart. Almost as striking in the other way are the declines of 1900. In 1901 prices were fairly steady, with advances in the latter part of the year, bringing another series of high points in 1902, though these are moderate in comparison with 1899. The sharp decline of 1903 is distinctly shown; the slight further decline extending over nine months of 1904, with advances in the latter part of the year; some reaction in 1905, followed by advances in the latter part of the year and a comparatively stable level for the first half of 1906. Then came a strong movement upward, carrying prices to substantially the levels of 1902, followed by recessions after the middle of 1907. The price maintenance movement modified the decline in the depression of 1908, and in the spring of 1909 came some abrupt declines, which stimulated buying and gave the strong upward curve of the second half of 1909. In general, 1910 was a year in which the price movement reversed that of 1909, pig iron reaching again its low points of 1909, while finished materials only retraced part of the distance to the bottom touched after the open market declaration of February, 1909. Steadily declining prices marked 1911. The break in finished material in May is plainly indicated in the pitch of the curves. November was the low month of the year and there was a slight recovery in December. Early in 1912, however, active competition developed a further decline and the low point for the year was touched in February in some products and in March in others. Gradually rising prices marked the late spring and summer and fall months, and on contract material the last three months of the year showed little change.

Prices used in plotti .g the charts are those asked by producers for delivery in from one to three months. In the second half of 1912 premiums were paid to secure desired deliveries of some forms of finished material, particularly plates, structural shapes and bars, and the difference between early delivery and forward delivery prices became most marked in September, October, November and December.

The Efficiency Engineer's Handicap

In a contribution to the Bulletin of the Efficiency Society for December, F. W. Collins, consulting engineer, New York, speaks pointedly on "Hampering the Engineer," as follows:

"A factor which must be accorded greater consideration in efficiency work is that of the personal element. It is one of the most difficult and elusive factors an efficiency engineer has to deal with. For it comes up in two principal ways: The people in charge of a property may be largely or utterly unfitted to have the voice in its affairs they enjoy; the engineer himself and his client may be temperamentally unsuited to realize the most from association. The second item above should be eliminated by frankly recognizing such limitations and engaging others on the work.

"In considering the first item it is obvious that complete success in business depends on three main elements (considered in narrow senses): Ability to buy, ability to organize and manage, ability to sell.

"Many a concern owes its existence to one man whose ability in one of these directions was most marked. Seldom are all three found in one individual. As a result it is frequent that its present-day inefficiencies are largely due to the strength and dominance of one of these elements. In a corresponding degree are the weaknesses present.

"It has been my experience to find a concern successful largely through the selling of its products, by a clever salesman, who heads it, or successful through shrewd buying, the plant itself being indifferently organized and managed, and the total efficiency at a low point. It is like putting an expensive toy in the hands of a child to put a properly organized and operated plant in the hands of such a head of a company. As a result the engineer is blamed for failure that is bound to crop out the minute his hands are withdrawn from the plant.

"More and more I have found that to insure permanence of results it was necessary to carefuly study those in authority and to adopt methods that in their hands would bring these permanent results. No bonus plan or scheme of organization or what not to increase efficiency of a plant can be entirely successful in the face of certain personal elements, if those elements are in control and are not properly considered. And no engineer's reputation is safe if dependent upon results that are to be secured by an inefficient executive, who will not agree to tactful changes around him."

Micro-Motion Study in Industry

The Important New Adjunct to Scientific Management—The Progress of Efficiency Producing Methods in 1912

BY ROBERT THURSTON KENT*

The progress of scientific management during the year just closed has been marked by a number of striking features. These include (a) the formation of two societies having for their object respectively the spreading of the principles of efficiency and the education of the public generally therein, and the collection and codification of the data of scientific management; (b) a governmental investigation into the merits of the Taylor system for government arsenals and workshops; (c) the presentation of a report on the present state of the art of industrial management, by a committee of the American Society of Mechanical Engineers, the consideration of which occupied two complete sessions of its annual meeting—no subject, let alone a single paper, ever before having consumed more than one session of a meeting of this society, and (d) the public presentation of an invention which should revolutionize the art of making time studies, the foundation stone of scientific management.

The above are the events which stand out most prominently in reviewing what has happened in scientific management during 1912. They are, however, the surface indications of a deep undercurrent of public opinion which has caused a self searching inquiry into the efficiency of industrial plants and processes of every description. This has manifested itself in two ways, (a) by the demands made upon the time of the engineers equipped to deal with questions of efficiency and management and (b) by the demand for literature upon the subject. A large number of books upon the subject of management have appeared during the year, all of which found a ready sale.

In fact, these books on management have been the best selling engineering books of the year. Two of these books are of such value as to warrant mention by name. The first is "The Principles of Scientific Management," by Frederick W. Taylor, the founder of the modern science of management. This book is an exposition in semi-popular form of the principles which underlie the movement. The second book is "Applied Methods of Scientific Management," by Frederic A. Parkhurst. The latter book is a detailed account of the manner in which the author applied the principles of Taylor in a machine shop, already highly efficient, so that costs were reduced and production increased, with an increase in the wages paid, to an extent hitherto regarded as impossible.

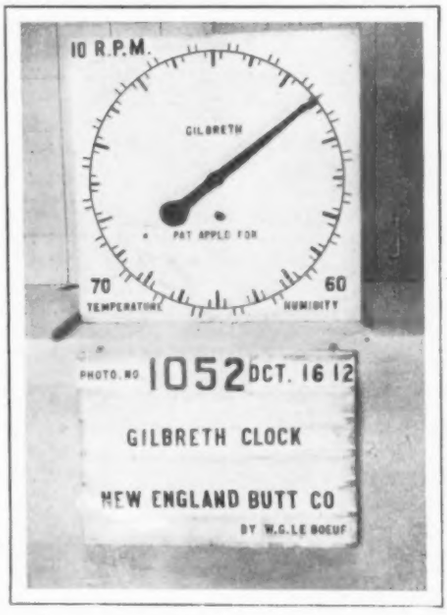


Fig. 1.—The Gilbreth Chronometer for Making Time Studies with the Motion Picture Machine

Consulting engineers who have made a careful study of the principles of scientific management have for the past six months been burdened with more questions and opportunities to improve the condition of industrial plants of all descriptions than they are able to handle. This has resulted in a mushroom growth of self-styled "efficiency engineers," who without adequate training or preparation are advertising themselves as ready to undertake the betterment of any industry whatsoever. These so-called experts are in the habit of making the most extravagant claims and offering to guarantee results which are impossible of fulfillment. This phase of the movement for scientific management in the industries was early foreseen by deep thinkers on the subject, and was predicted as long as three years ago. The rise of these "experts" who are using the phrase "scientific management" as a catchword with which to secure business, is but natural, as every great movement has its charlatans, quacks and fakers.

The Danger from Incompetents

While this was to be expected with respect to scientific management, it is none the less to be regretted. Many manufacturers, unable to distinguish the claims of these men and those of engineers who have passed through the long and necessarily rigorous training required to develop a competent management engineer, have been misled into engaging the services of the incompetent. As would be expected, the result to these manufacturers has been disappointing. The cost of production in many cases has been increased without any compensating advantages, and in a number of cases the manufacturers have gone back to the older methods after having thrown out the "efficiency expert," fully convinced that scientific management is a fraud and a sham.

The committee of the American Society of Mechanical Engineers recognized the danger from these incompetent men, and while it will somewhat disarrange the thread of this review, we cannot refrain from quoting the words of this report on this subject. "The position of the expert in the practice of management is very clearly seen as experience increases. The element of mystery has already departed. This is to be welcomed for it means the downfall of mere 'systematizers.' One of the unfortunate features of this great movement has been the rise of alleged experts who have been ready to promise extravagant results if they were allowed to systematize the industrial plant. The test with other work cannot meet as the one of permanence."

The test of permanence of their work is one which properly trained engineers should have to meet. These men have entered many industrial plants in the United States, reorganized them on the scientific basis, built up a self-perpetuating organization within the plant itself, and then have retired to take up work in other plants. The organization which they have left behind them is in every case carrying on the work according to the principles laid down by the management engineer, without friction and with as successful results as were obtained when the engineer was in close contact with the work. The manufacturer who wishes to make use of the principles of scientific management in his plant will have nothing to regret if he carefully investigates the antecedents and qualifications of the engineer whom he contemplates putting in charge of the job, and then makes his selection on the basis of the experience of the engineer, instead of on the basis of extravagant promises. Scientific management cannot be installed in an industry by a mere cost accountant. It is the work of an engineer who has undergone long and severe training for this specialty, and he who takes up with other than such an engineer for the re-organization of his plant does so at his peril.

The Scientific Management Societies

It is in this latter connection that the two societies above mentioned are going to perform one of their most valuable services to the public. The first society, named

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the Efficiency Society, is an institution of a broad educational scope. One of the duties it has laid out for itself is to investigate the qualities requisite for a successful management engineer, and to put the seal of its approval upon those of its members who are competent to undertake management engineering. The other society, known as the Society to Promote the Science of Management, is a much smaller society, operating along somewhat narrower lines. Its membership requirements are extremely rigid, being, in fact, more severe than those of the four major engineering societies. It is a distinctly professional organization, and except in certain very special cases, membership in one of the four major societies is a pre-requisite to membership in it. The membership is composed of men who have "made good" in the installation of the Taylor system, or the owners and operating managers of plants operating under the Taylor system. Associate membership in the latter society is confined largely to men who have not yet qualified as management experts, but who are under training in the plants of members or at work under the direction of members.

It is thus evident that as the work of these societies grows in scope and the societies themselves increase in age and membership, the public will have a very different standard by which to measure men who set themselves up as competent to handle industrial problems. It can put the questions to the would-be expert, "Have you been approved by the Efficiency Society as a competent management engineer?" or "Are you a member of the Society to Promote the Science of Management?" The man who is unable to present his credentials from either of these two organizations should at once be put down as one without the pale, and as unworthy to entrust with the vital and delicate problems of management or re-organization.

Broadly, the scope of the two societies is as follows: The Efficiency Society is a large organization made up of men from every walk of life, whose object is to educate the public to the extent of absorbing and applying the principles of efficiency in every art of every industry in this country. This it does by the dissemination of literature, by public meetings, by lectures and addresses. Its activities properly directed should prove an immense power for industrial advancement in this country.

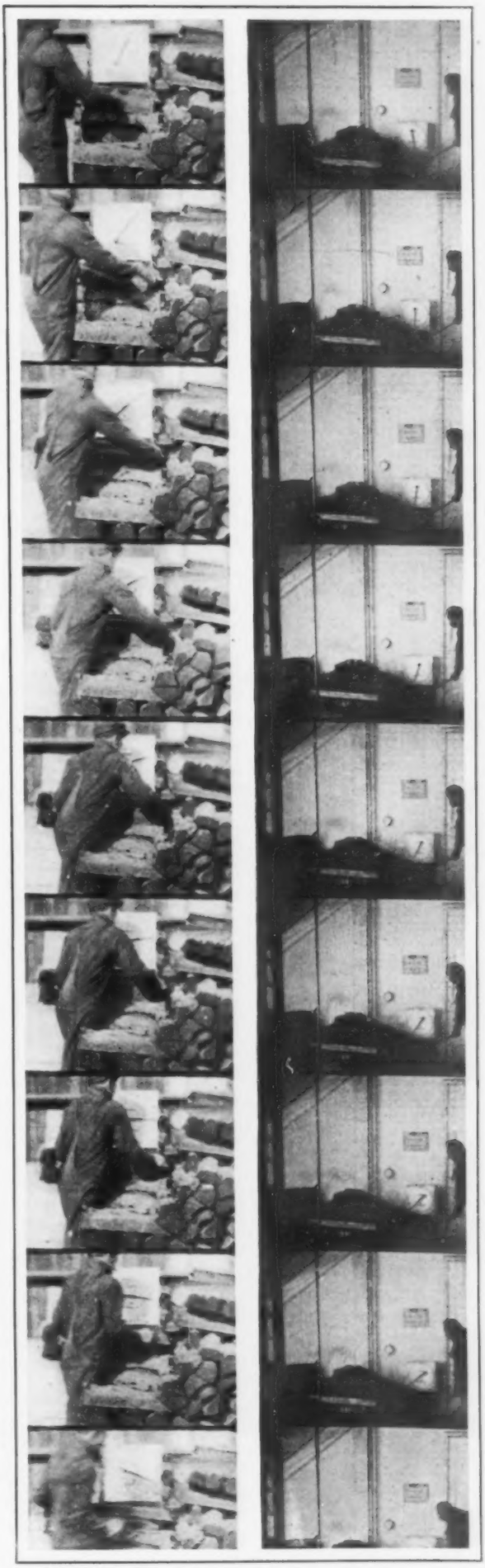


Fig. 2.—Typical Film Strips Enlarged About 50 Per Cent. Showing Successive Movements in Relation to Position of Clock Pointer

The Society to Promote the Science of Management is a strictly professional organization for the development of the laws of management, the collection and codification of scientific management data, and for definite research work on specific problems of management which are brought up by the experience of its members in different lines of work and the interchange of data and experience between the members and plants using the Taylor system. The work of this society is intensive, and while not carried on with the publicity and blare of trumpets of the larger society, the ultimate practical good accomplished by it undoubtedly will be as valuable or more valuable than the work of the larger organization.

The Governmental Investigation

In August, 1911, the House of Representatives of Congress adopted a resolution by which a special committee was directed "to investigate the Taylor and other systems of shop management, which investigation shall include its applicability to government works, its effect on the health and pay of employees, and the effect of wage and labor cost, and such other matters connected therewith, as may give a thorough understanding of the results of the installation of this system." This committee reported in March, 1912, after having examined a large number of witnesses, including management engineers, owners and managers of plants using scientific management, employees of these plants and of the government arsenals which were the immediate subjects of the investigation. The report makes a number of comments which are in part serious and in part amusing. As an instance of the latter, witness the following: "Neither the Taylor System nor any other should be imposed from above on an unwilling work-

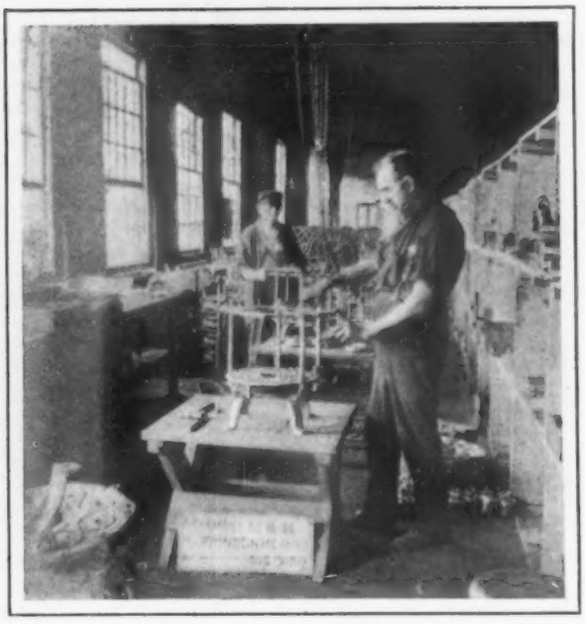


Fig. 3.—First Improvement in the Arrangement for Assembling as Developed by Micro-Motion Study

ing force. Any system of shop management ought to be the result of mutual conference and mutual consent, and that takes time. Government in a mill should be like government in a state—'With the consent of the governed.'" The writer wonders how far industrial progress would be advanced in a decade if every improvement that was proposed by the management should be submitted to the working force. In these days of militant labor unionism, progress would become retrogression if the above idea was commonly adopted.

With other comments of the report, however, the writer is in thorough accord: "Efficiency must not be had at the cost of the men, women and children who labor and who should be the primary beneficiaries from efficiency. We should state how to produce the best results in output while producing conditions to make the most efficient men and women to produce that output and this must be done by conserving in every way not only their health and physical and nervous vigor by creating such conditions as will permit them to work out their own happiness and contentment, secure wages which will enable them to live in such a manner as to maintain their own self respect and sufficient leisure to enjoy the refreshing influence of mental and moral recreation." Scientific management aims to do precisely this. The report reviews and comments on the various features of the Taylor system, and discusses in detail the subjects of standardization, systematization, planning the study of details of shop and work routing and stimulation. The report concludes with the following recommendations: "We recommend that wherever possible in government work, the machines, tools, nuts and bolts should be standardized, the management using continuous care that the cost of standardization shall not exceed the benefits to be derived from the same.

"Second. That the management should at all time give studious attention to the proper systematizing and routing of work, the grouping of machines, the furnishing of proper tools and equipment, and the elimination of waste motion and waste energy on the part of the workmen.

"Third. That careful study should be made of the machines in order to attain the speed and feed which will secure the highest and best possible production.

"Fourth. The management should put forth every effort to invite and induce full co-operation between the working force and themselves, and should, therefore, deal with the working force in the most open, frank and candid way, affording the fullest oportunity for consultation and explanation in advance of proposed action affecting the interest of the workmen. Stop-watch time study should not be made of workmen without their consent or any conditions be imposed upon them by authority which imply any indignity; piecework may be introduced where the work to be performed is a continuous duplication, but with the express understanding that piecework rates shall not be cut unless the conditions of production are materially changed; in other cases the rate should be straight day work rate at the highest prevailing rate for a similar class of work in the neighborhood where the government work is to be performed, except that by mutual consent bonus and premium work may be introduced, but only with scrupulous care that the workman shall have full opportunity for increasing his earnings without the risk of overstrain, for collective bargaining if he should so desire, and for easy and direct appeal to the management in any cases where he may think his interests threatened."

Report to the Mechanical Engineers

It may seem to the casual reader a trifle strange to record a committee report to an engineering society as one of the great developments of a movement such as that of scientific management. This report, however, is of great importance from a number of standpoints. In the first place, it marks the recognition by the most important engineering society in America that scientific management is not a theory, is not a fad, but is a definite scientific movement based on a true philosophy. It furthermore is important in that it announces a discovery of certain new and basic principles underlying the art of management.

This report was reprinted in some detail in *The Iron Age* of December 12, 1912, and we will therefore confine this review to comments on certain features of it.

The principle of the division of labor has now been recognized as of importance in economical manufacture. The report, however, brings forth another and more important principle, that of the transference of skill. Reviewing the viewpoints of a number of individuals favoring and opposed to scientific management, the deduction is made that the prominent element is "the mental attitude that consciously applies the transference of skill to all the activities of industry." The transference of skill is governed by three basic principles: The systematic use of experience; the economic control of effort, and the promotion of personal effectiveness.

In his discussion of this report at the meeting of the Mechanical Engineers, the author stated that underlying these three regulative principles noted above was a still greater principle—that of measurement. Measurement is the basis of scientific management. Heretofore, measurement of the efficiency of the worker has been made in scientific management by means of a stop-watch. The invention of a mechanical device which was the subject of the author's discussion is the last striking development in scientific management, during the past year.

Micro-Motion Study

Micro-motion study is the name given to the method of making time study by mechanical means which is the invention of Frank B. Gilbreth, and which has been referred to as one of the important developments in scientific management during the year. It is quite probable that this is the most important development, for it means the substitution of cheap machine work for extremely expensive hand work in performing this most vital function. The ordinary methods of making time-study are too well known to require comment here. The new method which was described by John G. Aldrich of the New England Butt Company and the writer in their discussions of the committee report to the American Society of Mechanical Engineers consists briefly in the use of the standard moving picture machine in connection with the Gilbreth clock or chronometer shown in Fig. 1.

This chronometer is set up alongside of the work to be studied. A moving picture of the operation and clock is made at such speed as may be desired. Various forms of chronometer are used, depending on the character of the work being studied. The one shown in the illustration is timed to make ten revolutions per minute, which with 100 divisions on the face enables readings to be taken to time intervals of half of one one-thousandth of a minute. Other chronometers are available in which the hand makes one revolution in 2 sec. and readings with this are possible to one fourteen-thousandth of a minute. The moving picture machine may be operated at any speed desired, so that successive pictures on the film strip will show movements less than one-half a thousandth of a minute apart.

In an operation like studying the movement of material about a plant by means of trucks, the moving picture machine would be operated rather slowly and the time intervals between successive pictures on the film strip would be somewhat coarse.

Fig. 2 shows two typical film strips. It reveals exactly how time-studies are made possible. The successive positions of the worker in doing any job are shown one after the other and the position of the clock pointer in the successive pictures gives the elapsed time in thousandths of a minute between each operation.

Micro-motion study, however, is more than a means of making time-study. It gives a permanent record of the methods of the best workmen. It automatically shows up wasteful movements in doing any kind of work. It will detect instantly any attempt on the part of workmen to defeat time-study by soldiering, for while a workman may deceive a time-study man, he cannot deceive the camera. Every movement he makes or every lack of movement is recorded in the form of indisputable evidence.

Furthermore, the complete film may be used to develop best methods of doing work. For instance, conceive of two men, A and B, doing the same job, both showing approximately the same efficiency. Micro-motion study would reveal that the first three motions of A were extremely efficient, while the second three motions were inefficient. Conversely, the first three motions of B were inefficient, while the second three were highly efficient. A study of the film showing the work of both A and B would reveal a combination of the efficient movements of the two, indicating a method of working which would be more efficient than that of either. Once the best method has been developed and recorded by micro-motion study, a complete instruction card for that method is taken. A continuous photograph of a job is of much greater value in instructing a man what to do, how to do it, when and in what time, than a whole book of written or printed instructions. It is easy for the reader to develop for himself numberless applications of this method.

As a summation of the possibilities of micro-motion study, the writer can do no better than quote the following extract from his discussion before the American Society of Mechanical Engineers.

Mention has already been made of the importance of measurement in scientific management.

Analysis of Value of Micro-Motion

Micro-motion study is the most powerful tool ever offered the engineer to measure the efficiency of the worker. Time-study is the basis of all modern management. The provision of a machine to make time-study should be as revolutionary in the art of time-study as was the invention of the power loom in the art of weaving. Among other things it absolutely eliminates the human equation. It provides a method in which there is not only no possibility of error in measurement, but which furnishes at once a true statement of the time elapsed in the performance of any operation and a record and instruction card of the best methods of doing a job.

In "The Psychology of Management" the following statement appears: "Measurement is a most necessary adjunct to selecting the workers and the managers and assigning them to the proper functions and work. They cannot be selected to the greatest advantage and set to functionalized work until (a) the unit of measurement that will of itself tend to reduce costs has been determined; (b) methods of measurement have been determined; (c) measurement has been applied, and (d) standards for measurement have been derived." It is obvious that micro-motion study at once presents a means of most economically determining and applying all these standards.

It was the writer's privilege to be present at many of the experiments which led to the development of micro-motion study and to observe how it was applied to the transference of skill and experience. Scientific management makes use of the best methods of all trades which can be transferred to the trade under consideration. The experiments under which micro-motion study was developed are an illustration of this point. The work involved was the assembling of braiding machines, obviously a machine shop proposition. The original method of assembly involved the bringing of the various pieces to the job in a box or boxes, from which they were taken as required by the worker. Many unnecessary motions were used in the transfer of the individual pieces to the growing machine. These unnecessary motions were promptly revealed by the moving picture machine. The second step in the development is shown in Fig. 4. A bench which would bring the top of the completed machine at a convenient level for the workman was built and the parts were arranged in an orderly manner in bins behind him. This reduced the number of motions, but there were still more than were necessary.

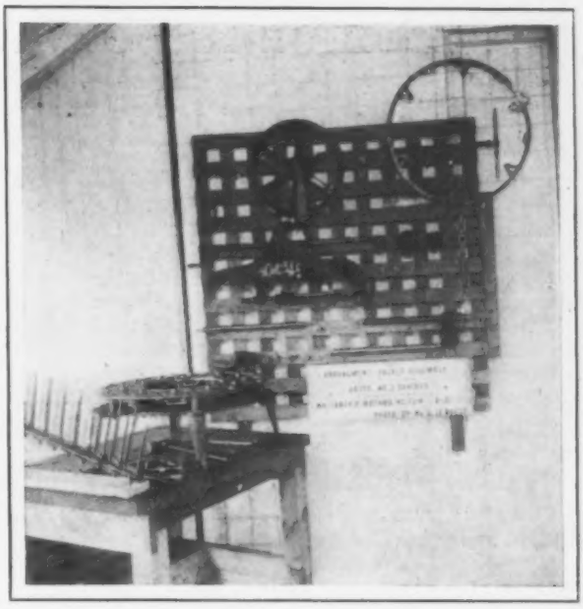


Fig. 4.—The Final Arrangement of the Assembly Pocket as Developed by Micro-Motion Study

In other trades in which some of the experimenters had been engaged it had been found advisable to group the units composing a single assembly on a packet, arranging them in the order in which they were needed. This suggested a similar packet scheme for the parts of the braider. A horizontal packet was first made up and the motion picture machine revealed an irregularity and lack of rhythm in the movement of assembling which seriously cut down the efficiency of the workman. A change to a vertical packet and a standard height of portable assembly bench was thereby indicated, and after a few experiments the arrangements shown in Fig. 3 was devised. On this packet the various parts were hung on pegs in that exact position which micro-motion study had revealed as the most economical of motions both as regards time and length of travel. Fig. 4 shows the relative position of the assembly bench, the packet, the workman and the machine which is being assembled. A comparison of this illustration with Fig. 4 will show in how much better position the workman is for his work than in the former illustration, which is shown, and which is a vast improvement over the usual method. Micro-motion study revealed the deficiency of each method and permitted the development of the final accepted method in a small fraction of the time and expense which would have been necessary under the conditions which existed before its invention.

Alaska tin mining, according to the United States Geological Survey, is assuming promise of practical results, the report being as follows: "The dredge which was installed on Buck Creek last year was operated throughout the open season of 1912. It is currently reported that the output of 1912 is much larger than that of 1911. The Lost River lode-tin property has been bonded and is now being systematically developed. The results of these operations in 1912 are reported to justify further investments and the installation of a mill. This property promises to become the first productive lode-tin mine in Alaska."

The corporate name of the Dearborn Drug & Chemical Works, McCormick Building, Chicago, has been changed to Dearborn Chemical Company.

Combining Steam and Gas Power

The Mesta Machine Company's Power Plant and Its Methods—The Important Economies Which Have Been Effected

The power plant of the Mesta Machine Company, Pittsburgh, Pa., builder of power plant equipment and steel works machinery, is of unusual interest because it is entirely equipped with prime movers of the company's own design and manufacture, because it is a combination of steam and gas-power installation, and because it is the testing and proving ground for many of the innovations which are brought out in the works. The latter feature naturally results in departures from the standard practice as found in strictly commercial power plants.

The power house, centrally located with the length of the plant, is of structural steel and reinforced concrete, and covers an area of 93 x 114 ft. The L-shaped engine room is at the works level, while the floor of the boiler house, which fills the angle of the L, is 14 ft. lower, the arrangement being shown in Fig. 1. The engine room is high and well lighted by means of skylights and its light colored walls increase the illumination.

The 250-hp. Cahall boilers, Fig. 2, are installed in three batteries of two each. Five boilers are used continuously, as the steam hammers and the forging presses of the company require a large amount of steam. The fire-brick setting surrounds the boilers to a hight of 32 ft., to the base of the 3-ft. stack which rises from each boiler 90 ft. above the floor.

The coal, an inexpensive grade of slack, is dumped into the outside bin from the cars on a switch 13½ ft. above. As the coal is required it is shoveled through openings in the side of the bin and is carried by two endless chain elevators to a great sheet iron hopper which inclines downward toward the boilers at an an angle of 45 degrees. The feed to the hoppers of the Roney stokers is controlled by levers in easy reach of the firing floor. Under the fireman's stand is a 10-ton ash storage. The night turn handles all ashes, loading them by means of the coal elevator, reversed, directly into a car on the switch on the outside.

The boilers are fed from a Cochrane open feed water heater, located 15 ft. above the firing floor. The feed water falls into the Michigan single cylinder plunger pump on the floor beneath the heater, which insures good suction head for 200 deg. F. water. Two other pumps are available for pumping direct to the boilers from the gas engine and air compressor cooling lines. Should an emergency arise, cold water may be fed to the pump from the city main.

The Engine Room

In the engine room, Fig. 3, are two steam engines, a steam-driven compressor and a gas engine, all of the Mesta make.

The two simple non-condensing steam engines are alike —28 x 42 in. horizontal Corliss type, running at 100 r.p.m. The full load rating is 750 hp. Each is directly coupled to a 400-kw., 250-volt, 10-pole, compound wound Westinghouse D.C. generator.

The air compressor is a two-stage, horizontal, cross-compound machine. The steam receiver pressure between the high and low pressure cylinders is 20 lb., the back pressure 3 lb. and the air tank pressure 110 lb.

Between the high and low pressure air cylinders is

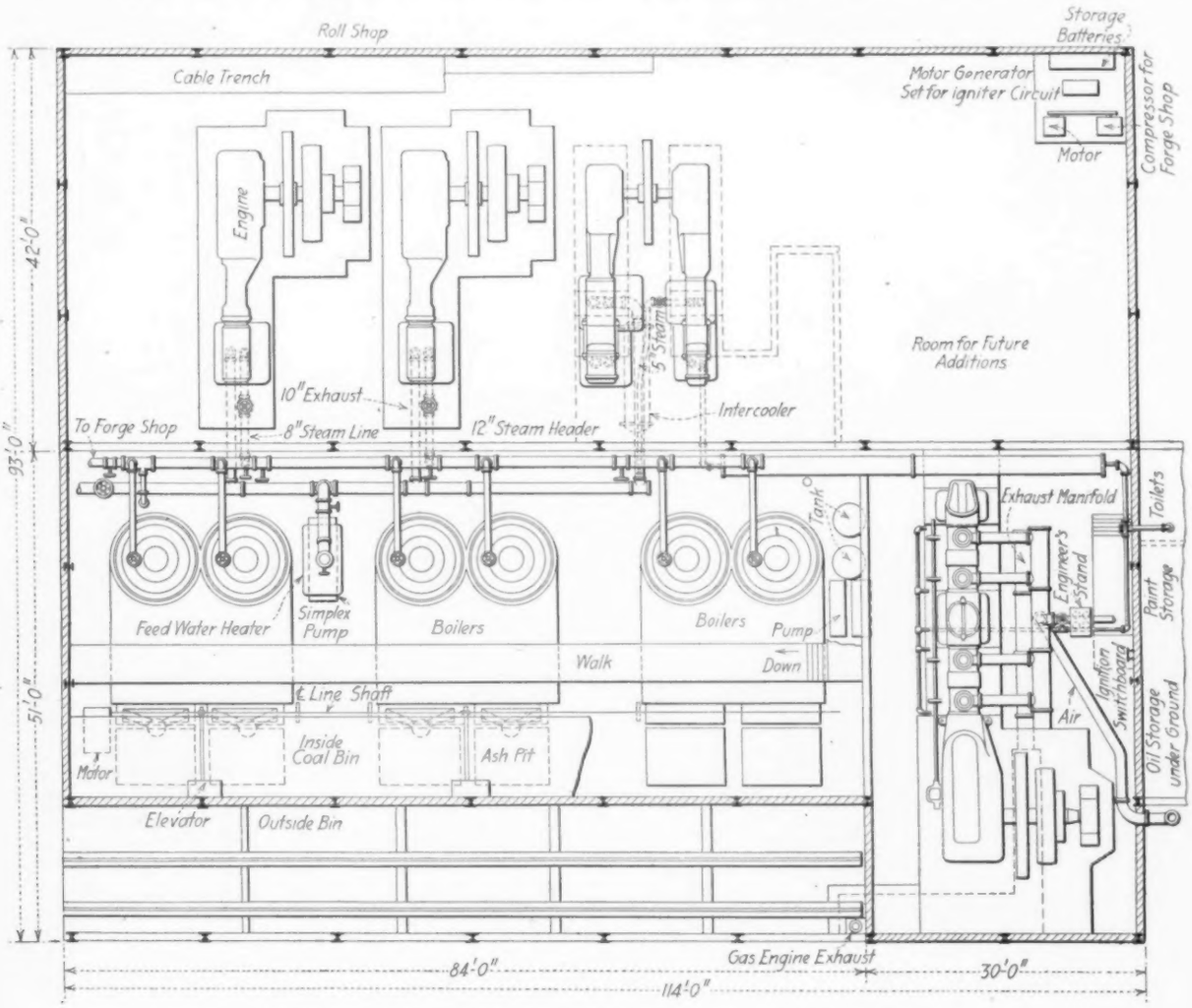


Fig. 1—Ground Plan of the Power Plant of the Mesta Machine Company

a 61 tube intercooler, carrying 30 lb. air pressure. The tubes are of 1⅜-in. diameter, 130 in. long, and are partly filled with central cores made of pipe closed at both ends, a design which produces a high water velocity and therefore a large heat transfer per square inch of cooling surface. The tubes are surrounded by air.

On this machine are two types of air valve. The ordinary rocking valve, a part of the original equipment, is used on the inlet of the high pressure side, and on the crank end inlet of the low pressure side. On the head end inlet of the low pressure there is a single 18-in. Iversen automatic plate valve, and a similar valve is used on the outlet, and six of this design on the crank end for inlet. These valves were installed for test purposes before the Mesta Company adopted them for their standard practice. The Iversen valve has been fully described in a paper entitled "Reciprocating Blast Furnace Blowing Engines," by Prof. Trinks. (See A. S. M. E. Proceedings of July, 1911.) At that time data concerning the life of the device were not available. The valves were installed in April, 1911, and have not been touched since. The compressor speed varies between 60 and 100 r.p.m., which is higher than is ever required for blowing engines. At this date (November, 1912) the valves have a life of 18 months or, expressed in a more practical unit, of 18,000,000 revolutions. With an engine speed of 60 r.p.m., 24 hours per day, this is equivalent to 6.9 months.

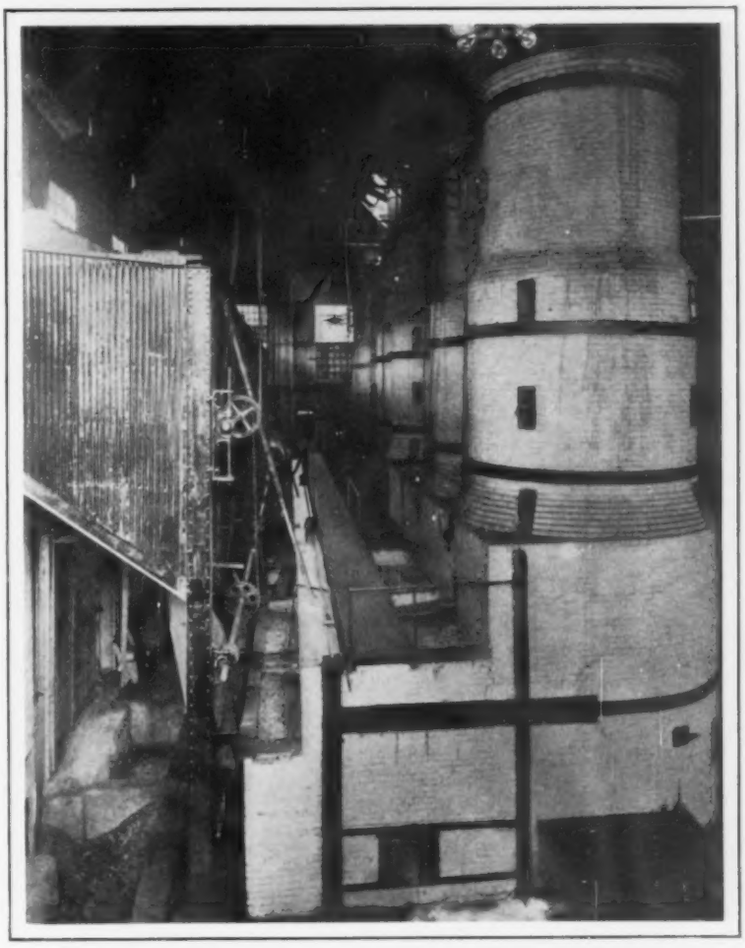


Fig. 2—The Boiler Installation at the Works of the Mesta Machine Company

Tank Pressure for Varying Speed

The compressor supplies a varying demand. Efficiency under these conditions requires a dependence of the r.p.m. on the air tank pressure—a dependence that can not be obtained by attempting to govern through the change of m.e.p. of the air side, as this is practically constant at all speeds.

The Mesta system for varying the speed with the tank pressure is shown in Fig. 4. The piston in chamber A is in equilibrium between the upward tank pressure and a downward spring force. A change of pressure produces a movement of point B and therefore a movement of point C, since point D is stationary as long as the speed remains constant. The engine cutoff is thereby changed and, since the m.e.p. of the air side is practically constant, the engine varies its speed. The m.e.p. on the steam side can only change value temporarily, as otherwise the engine would either stall or run away. Point C in different positions produces different m.e.p.'s and must always return to a certain position corresponding to a definite cutoff. The flyball governor is of great stability. A large variation of speed is necessary to change the position of point D, i.e., to bring point D back to its original position.

Wear is taken up in the valve stem bushings in an ingenious manner, shown in Fig. 5. Since the load on the rod is alternately up and down, the hole in the bushing will, after several years' continuous operation, wear into an oval with its long axis vertical. The gear then runs noisily, due to impact of the stem as it is pulled up and drops down in the loose bushings. Instead of remedying this by the insertion of a new bushing, a small half brass was placed under the stem and raised by means of a set screw. The stem thus finds a bearing between the top of the regular brass and the new adjustable brass, allowing the valve gear to run without noise at all times.

The 23 by 32 in. horizontal tandem double acting gas engine is directly connected to a 400-kw., 250-volt, D.C. generator of Westinghouse make. An article on the design features of the Mesta gas engine may be found in *The Iron Age* of October 10, 1912. There are, however, additional interesting points about this particular installation.

The exhaust manifold runs 3 ft. into the foundation,

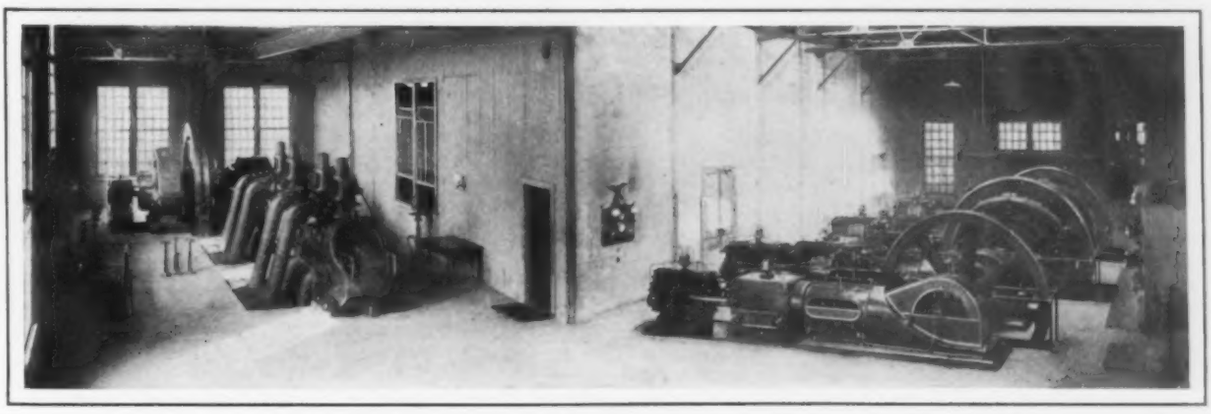


Fig. 3—The Engine Room of the Mesta Machine Company

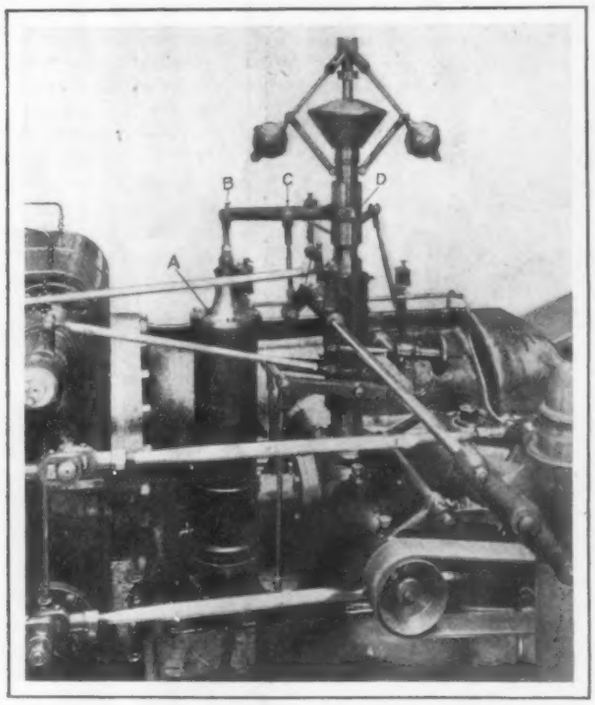


Fig. 4—The Mesta System of Varying Compressor Speeds by Tank Pressure

and is firmly imbedded in the concrete. Since concrete and iron have the same co-efficient of expansion, the joint between them must, of course, always remain tight. The section of the exhaust passage changes abruptly from a 20-in. circle to a rectangle 3 ft. wide by 4 ft. high. This exhaust tunnel is straight for 18 ft. from the exhaust inlet, and then extends 15 ft. at right angles with the original direction. The exhaust pipe, also imbedded in the concrete, rises from the far end of the tunnel. The muffling with this arrangement is perfect. The exhaust cannot be heard at any point inside or outside of the power house.

A small but useful device for the gas engine is a type of tell-tale, Fig. 6, for indicating at a glance the ignition in the cylinders. The core A of the induction coil, being magnetized while the igniter points are in contact or the circuit closed, attracts the steel B fixed to the aluminum tell-tale C. If the igniter is working correctly, the tell-tale flips up into position *a* at every other revolution. If it stays in one position there is a short in the circuit. The tell-tale constantly in position *b* indicates an open circuit or a ground.

The piston rings on this engine have given great satisfaction. The work done by the engine during the average life of a ring to date has been 1,350,000 kw. hours. With a steady operation of 20 hours per day, 300 days per year, at 80 per cent. full load, this represents a life of 8½ months. The cylinders, after two years' service, are highly polished without scoring and show practically no wear. The action of the engine under varying load is very satisfactory. The maximum variation in voltage for a sudden rise from no load to full load is 2 per cent. All the machines are carefully inspected twice weekly to discover any loose parts. The switchboard has the usual apparatus together with a Thomas watt hour meter.

The Gravity Oiling System

The gravity oiling system, Fig. 7, was built by the Mest Company from its own design. It fulfills the following requirements in addition to those met by most filters: It avoids water purification, an advantage because the water may have been chemically treated and would often form an emulsion with the oil. It provides a mud filter for the oil. It is easily cleaned as it eliminates filter bags. An oiler can clean the system in thirty minutes. The oil returns from the engines through a 2-in. line, and after passing through a fine strainer which covers chamber B, goes to the bottom of the tank through the long tube. This places the oil with its dirt particles and water content at the bottom of the tank. The purification by gravity follows, i.e., the water stays at the bottom, the slime forms a layer on top of the water and the clear oil rises to the top. The layer of slime itself is a mud filter. Tank B overflows into tank A, from the surface of which the pump supply is taken, at a point where it will not draw directly from the oil just entering the tank. The pure oil is forced up into a 90-gallon tank, 17 ft. above the engine room floor. A float and bell arrangement gives warning of low oil level.

The filter is cleaned by closing the overflow into tank A, and opening the overflow into tank C. The old oil is floated out of the tank by introducing water, and afterwards the water is drawn off through the cock D. The refuse oil tank C furnishes an excellent lubricant for the cranes.

This plant shows economy in the use of water and heat. The path of all water is, in order, from the city main to the compressor intercooler, gas engine and reserve tanks, whence it follows two paths, first, the boiler supply; second, that of the excess supply to the toilet rooms of the entire plant, the kitchen in the main office building, and the foundry for wetting the sand.

The steam engines run non-condensing because heat is required for the shops and offices during the greater part of the year. The exhaust steam may pass through the feed water heater, through the heating system or directly to the atmosphere, or through all of these paths. The steam pressure on the heating system is maintained at 3 or 4 lb. On account of the excessive cost of an exhaust steam line, the heating line to the office carries live steam which is throttled down to 3 or 4 lb. at the building. Fittings are installed for providing all of the heating system with live steam should the contingency arise.

Some of the plant's costs and records are of value. Daily, the following observations are recorded: Readings of the gas meter, water meter, revolutions of the air com-

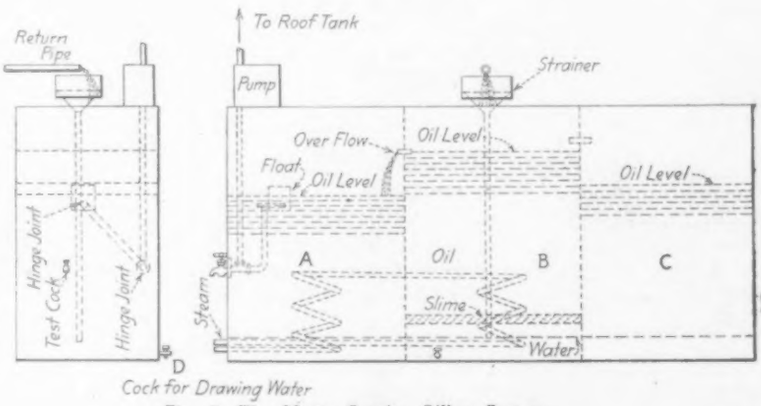


Fig. 7—The Mesta Gravity Oiling System

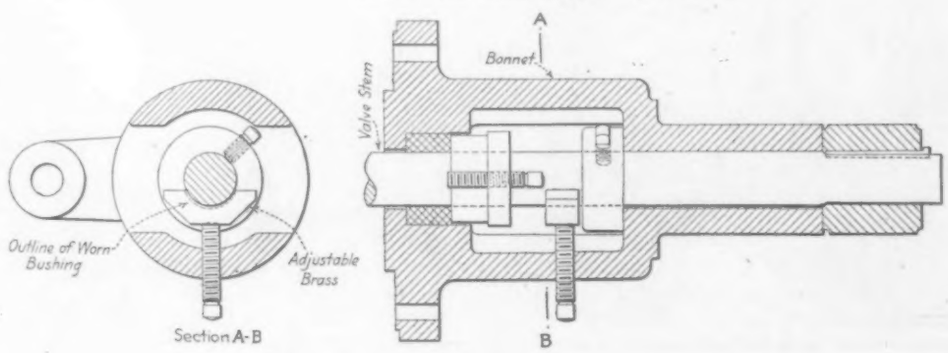


Fig. 5—Method of Taking Up Wear in Valve Stem Bushings

pressor, coal and oil used, and kw. hours produced. A late monthly report gives the following data:

Total K. W. hours produced	230,640
K. W. hours produced by gas engine	185,040
Gas (32° F., 14.7 lbs. per sq. inch), cu. ft.	3,674,000
Gas per K. W. hour, cu. ft.	19.86
Water used, gal.	1,800,000
Engine oil used, gal.	50
Cylinder oil used, gal.	175
Air compressed (14.6 lbs. per sq. in. 60° F.) (compressed to 110 lbs. per sq. in.), cu. ft.	33,000,000

Many data concerning costs of steam engines and compressor installations have been published, but with gas engines such figures are scarce. The gas engine installation of this particular plant shows:

	Per K. W.
Engine, accessories and foundation	$41.00
Generator and switchboard	13.10
Piping and storage tanks	1.75
Stacks and flues	0.20
Erection	3.78
Total exclusive of building	$59.83

The engine room is attended by an engineer and an oiler in the day, and an engineer only in the night. The boiler room is served by a fireman and two unskilled laborers day and night. It will thus be seen that the combination of gas and steam power, together with the employment of exhaust steam for heating, with the use of cooling water for other purposes, and with close supervision, produces excellent results.

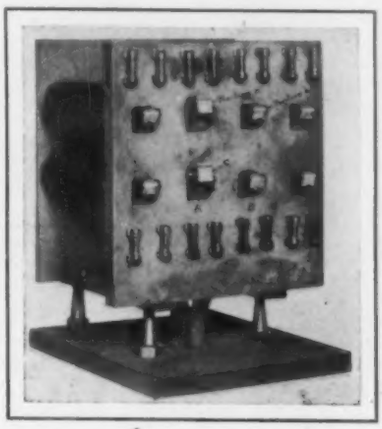


Fig. 6—The Tell Tale for Watching Ignition in Gas Engine Cylinders

Merchant & Evans Company's Business

The Merchant & Evans Company, Philadelphia, Pa., furnishes an interesting statement regarding the course of business in 1912. It is in part as follows:

"As a manufacturer of tin and terne plates, ventilators, metal tiles, metal shingles, solder, babbitt, newspaper metals, automobile parts, and as a jobber in materials generally used by metal workers, machinists, foundries, ship, car and engine builders, electrical workers, hardware and stove dealers and automobile manufacturers, our experience is somewhat more varied than exists with the average tin plate jobber and manufacturer. The condition of our business, as compared with business one year ago, shows a marked improvement. In some departments the increase has been over 100 per cent. In sheet metals single orders were received approximating 500,000 lb. In mixed metals individual contracts of $100,000 were arranged. Our brass and copper business exceeded expectations. In clutches and other parts for gasoline commercial vehicles, our volume of business kept abreast if it did not actually exceed the rapid development in this important industry.

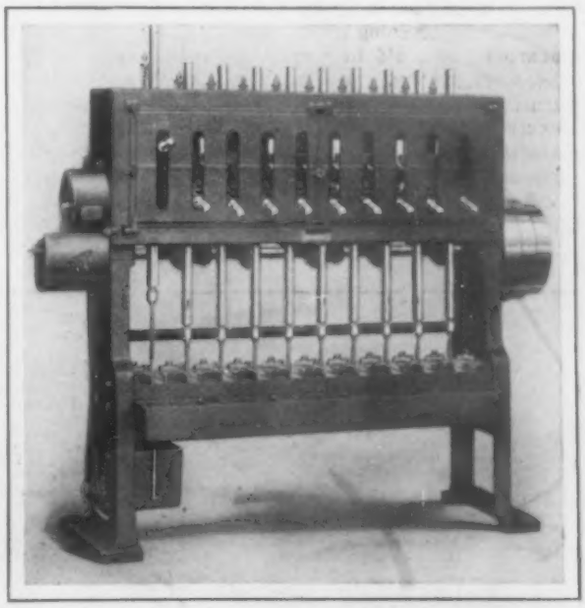
"The volume of our business in 1912 we conservatively estimate as at least 30 per cent. greater than in 1911. Both prices and profits were on a higher level. The present status of our collections is most excellent, probably owing to a systematized and careful administration in our financial department. In December, particularly in the early part of the month, our remittances assumed banner proportions, really creating a record in the history of our organization. Our losses through bad debts in 1912 as compared with 1911 averaged less, although for years our profit and loss account kept well within the limits recommended by conservative, soundly informed banking economists.

"In 1912 some departments of our works were taxed to their fullest capacity to care for the pressing necessities of our customers, and during a portion of the year were compelled to operate night shifts. This indication of a prosperous trade condition had really been foreseen by jobbers and manufacturers generally throughout the United States. As for ourselves, early in the year we negotiated for a site in the Wheeling-Pittsburgh district, where fuel, transportation and ideal manufacturing conditions obtain. Location was eventually made in Warwood, just outside of Wheeling, where we erected an up-to-date tin plate dipping plant. We secured 250 acres of coal lands. Our dipping plant equipment in Philadelphia has been removed to the new location, and extensive alterations and additions to the Philadelphia plant are now in progress to care for our greatly increased business in automobile parts, tire cases, Star ventilators and mixed metals. All our plants in Philadelphia, Chicago and Warwood are now running full time. Prospects for business in 1913 appear to us most favorable."

A Semi-Automatic Nut Tapping Machine

The 1½-in. 10-spindle semi-automatic nut tapping machine here illustrated is the latest type which has been brought out by the National Machinery Company, Tiffin, Ohio, to handle either rough hot pressed or cold punched nuts. The most important improvement is the addition of a rapid change gear box which controls the speed of revolution of the tap spindles in relation to their raising and lowering to conform with the number of threads of the tap which is being used. With this mechanism the shifting of a hand lever replaces the removal and substitution of gears. The older method consumed considerable time of the operator or foreman and therefore changes were infrequent. This ease of operation also enables the workman to reduce the spindle speed as the cutting teeth of the tap are reduced in number by grinding. The result is that there is little or no idle working time.

In the semi-automatic machine the spindles are raised and lowered by cams, and the operator escapes the fatigue incident to treadling and can devote his entire energy to feeding the work to the taps. This automatic action of the spindles also tends to prolong the life of the taps, because the action is certain, no danger existing of jamming the tool in the nut or of twisting off the shank or stripping the teeth, which may result when dependence is placed upon the physical effort of the workman. The cams have three steps and by shifting the cam shaft the resting time of the spindle when raised can be fixed to conform with the limit of speed in feeding. The spindles are set close together, the 10 occupying a space of 69 in., which facilitates feeding and enables the operator to serve the whole machine with facility.



National Machinery Company's 10-Spindle Semi-Automatic Nut Tapping Machine

The nut holders are of simple design. The nut guides are wedge-shaped chilled plates held in position by toe clamps. The guides are backed by stationary lugs of corresponding angle located on the feeding table, rendering them rigid and insuring a parallel position of the guide faces, as these are clamped against the stationary lugs.

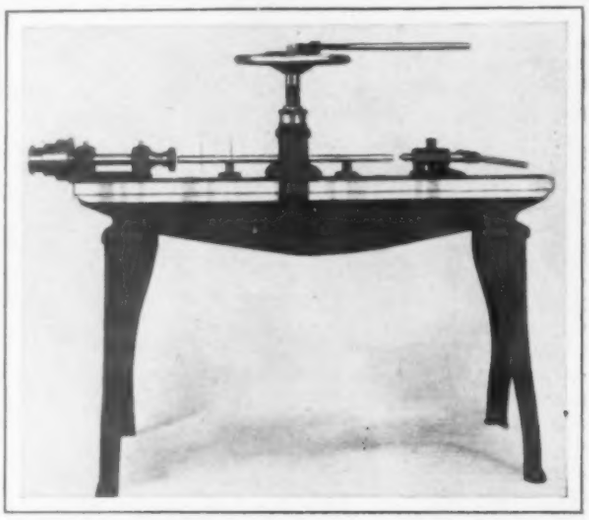
New Rockford Machines

Improved Types for Centering and Straightening Cold Rolled Shafting

The Rockford Drilling Machine Company, Rockford, Ill., has developed new machines for centering and straightening shafting. The centering machine is designed for rounding the ends and drilling the center holes in cold rolled shafting and may also be employed for forming shapes such as handles or grooves, and for use where the bar is shouldered down to a given size. The work is held and driven by a three-jawed universal chuck and is supported at the working end in a steady rest, which has an alloy bronze half bushing for the lower part of the bearing and two hardened steel rolls which are adjustable in the hinged upper part. Because of this construction the work runs so smoothly that it cannot be marred. Each size of shafting requires its own lower half bushing. A suitable cross slide operated by hand carries a forming tool for rounding and chamfering and is provided with a back stop for gauging the depth of the cut.

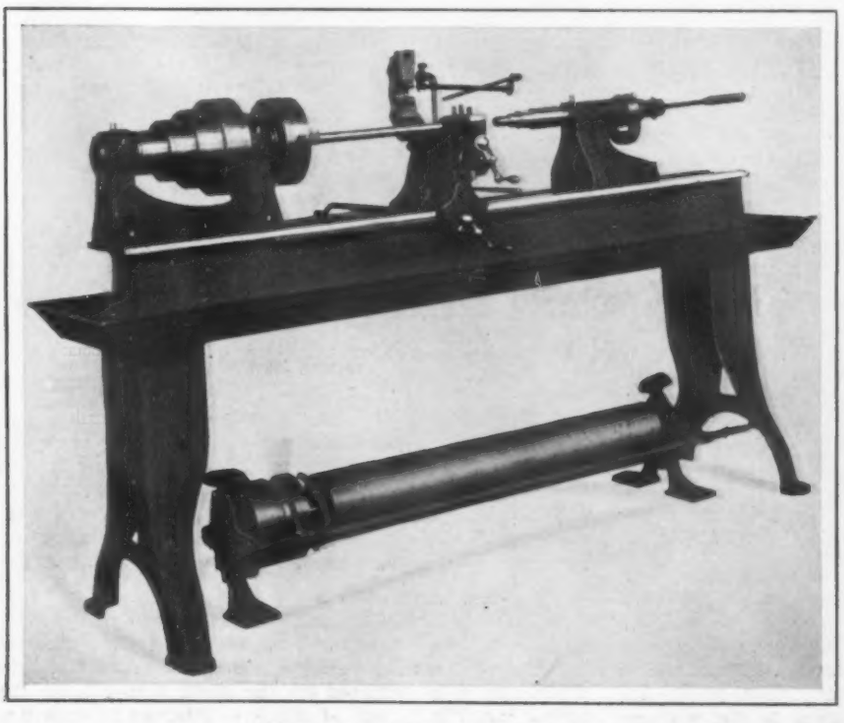
When this operation is completed the cross slide is run to the front against a stop which permits a guide ring to come into position exactly opposite the center of the shaft. The ring, being part of the slide, is, of course, stationary when against the stop. The tail stock spindle, which carries the combined center drill and countersink, has a revolving inner spindle, on the end of which is a second hardened guide ring which fits into that of the cross slide and guides and steadies the drill and countersink. The shaft revolves in one direction and the drill in the other. This combination of motions, with the action of the steady rest, creates a condition whereby a very true center is drilled. There are two countershafts, one for the head stock cone and the other for the tail stock spindle, the latter carrying a drum long enough to cover the adjustment of the tail stock. The head stock spindle is hollow, so that any length of bar up to 2¼ in. diameter can be passed through. The bed is 8 ft. long. The greatest distance from the chuck to the center reamer is 62 in. The machine is equipped with pan and oil pump.

The straightening machine is designed for straightening shafting up to 2¼ in. diameter and 8 ft. in length. The head stock spindle, which always runs at a slow speed when the machine is in use, carries a center and a spring chuck having a leather friction face for revolving the shafting when it is picked up between the centers. Supporting blocks bored 1/16 in. below the spindle line act as a rest for the work while it is being straightened. The forward movement of the tail stock spindle picks it up between the centers and forces it against the leather friction, which lifts it from the supporting blocks. As the shafting revolves the operator chalks the uneven and untrue spots and then pushes back the tail stock spindle, permitting the work to drop upon the block. These are adjusted lengthwise to the proper position, while the screw press, which is carried in trolley run on rollers, is brought down with the proper amount of pressure. The thrust



The Rockford Shaft Straightening Machine

of the screw is shod with a brass pad so that the shaft is not marred. A lever is provided when greater pressure is required than that which the wheel of the screw press will furnish, but in most cases the wheel gives sufficient power, the screw being a fine thread. The press is provided with a graduated dial register as a means of determining whether the application of pressure has been sufficient.



The Rockford Shaft Centering Machine

British Foreign Trade in Iron and Steel

The total of iron and steel exports from Great Britain in the 11 months ending with November was 4,548,471 tons against 4,241,911 tons in the first 11 months of 1911. The value was £44,639,050 this year and £40,435,080 last year. Rail exports increased from 331,664 tons to 377,878 tons and pig iron exports from 947,027 tons to 1,032,271 tons. Exports of spiegeleisen, ferromanganese and ferrosilicon not included in the above were 148,629 tons this year to November 30, against 123,409 tons. Galvanized sheets are an important item in the export movement, the total to November 30 this year being 598,768 tons, against 567,472 tons. The largest market for these sheets is British India, to which shipments were 154,373 tons this year and 135,200 tons last year to November 30.

British imports of iron and steel have shown a larger relative increase than the exports, the total to November 30 this year being 1,868,141 tons, against 1,650,398 tons.

William Wilkoff, president Wilkoff Brothers Company, Youngstown, Ohio, has bought the interests of the other members of the company and the three retiring members have organized the Wilkoff Iron & Steel Company with a capital stock of $100,000. The new company will engage in the scrap business and will have offices at 505 Mahoning avenue, Youngstown. Samuel Wilkoff is president of the new company and D. J. Wilkoff is treasurer.

A Simple Bonus System and Its Results

Its Operation by Standard Motor Construction Company—Striking Examples of Large Economy in Production Costs—Some Indirect Benefits

BY W. L. MYLES

About four years ago, the differential bonus plan of wages was introduced in the plant of the Standard Motor Construction Company, Bayonne, N. J., manufacturers of marine gas engines, as a means of affording substantial justice to the employee, while requiring him to conform to the best interests of his employer. The employee was not told in a direct way "to do better" or "work harder," but a definite standard was set for him, and he was shown and directed how to reach that standard, for which he was awarded a compensation in addition to his regular wage.

The bonus system is indicated in a genetal way by references to the accompanying forms which are used in this plant. But before describing this system, the writer wishes to state that he has endeavored to bring it to a

Storekeeper—Please furnish material for

Shop Order..... Part No..... Bin No.....

No. Pieces	DESCRIPTION	Weight	Unit Price	Total Price	

Date..... Foreman

Form 108.

Fig. 1—The Foreman's Order for Material

state of perfection without the unnecessary red tape and long list of useless forms which are found in many of the so-called scientific systems now in use. It was not launched upon the men all at once, but was developed gradually, and as new and better methods of performing the work were found they were adopted, until after four years of careful study and observation, we have built up a system that produces the results which the manufacturer of to-day is striving to obtain, namely, compensating the mechanic in a satisfactory way for the extra effort put forth on his part, at the same time materially reducing the cost of manufacturing. It has created that spirit of co-operation between employer and employee which is so essential to a successful business, bringing a higher degree of efficiency.

Needless to say, it was not all smooth sailing to install and bring the system to its present state. Much criticism regarding the methods of work had to be endured and many obstacles had to be removed before we could secure anything like harmony. The men were told that the stop watch method would make mechanical tools out of them, rendering them in a short time an object for the scrap pile. It was a hard task to convince them that the company had no selfish object in view when offering the men the system, as was suggested by the critics, who openly declared that "to show your best efforts meant a cut in wages which would result in obtaining large profits for the company without any compensation to the working man." Unions of course objected, chiefly because it brought to light those men who were not capable of producing the day's work for which they were paid.

I remember well the first bonus job we put into the shop. After making a time study and writing out the instruction card, I personally delivered it to the mechanic, who immediately threw down his tools and quit his job, as likewise did the second and the third. But as one after the other earned bonuses the men became convinced that the company was interested in their welfare and stood ready to compensate them for extra effort on their part, so that to-day there is hearty co-operation. I seldom go out into the shop that some mechanic does not stop me and ask if I am going to put his job on bonus or "when do we get bonus?"

BIN NO.

NAME OF ARTICLE | SYMBOL

DATE RECEIVED OR ISSUED	SHOP ORDER NUMBER	QUANTITY RECEIVED	QUANTITY ISSUED	BALANCE

Fig. 3—Bin Tag, the Record of Each Item of Stores

As everything received from the foundries and from other sources is delivered to the storeroom, it is necessary for a mechanic to secure from his foreman an order for any material which he may require. Fig. 1 shows the form used for this purpose. The foreman enters on the slip the shop order number, part number and number of pieces required and it is given to a trucker who delivers the material to the machine, while the mechanic is getting his drawings and tools ready. The store keeper enters upon the slip the bin number and the weight. At the end of the day all slips are sent to the cost department where they are charged off in the "balance of stores" record book of which a sheet is shown in Fig. 2.

CLASSIFICATION | SHOP ORDER | BIN NO. | UNIT | FOLIO | MAX. | MIN.

	ORDERED			RECEIVED				UNIT PRICE	ISSUED				BALANCE		ISSUED				BALANCE	
	DATE	Order No.	QUANTITY	DATE	Order No.	QUANTITY	VALUE		DATE	REQ. NO.	QUANTITY	VALUE	QUANTITY	VALUE	DATE	REQ. NO.	QUANTITY	VALUE	QUANTITY	VALUE

Fig. 2—The Balance of Stores Record Book

The Perpetual Inventory

On these sheets, which are in a loose leaf binder, is kept a record of all material received, given out and the balance on hand, together with the values, thus creating a perpetual inventory. As the material is taken from the storeroom it is deducted by the store keeper upon the yellow tag, Fig. 3, one of which is attached to each bin.

They show at a glance the quantity received, quantity issued and balance on hand, which should correspond with the record in the balance of store book, kept by the cost department, revealing any discrepancies. After material is received by the mechanic, an identification tag is attached to it, Fig. 4.

The work is now ready to be put on bonus. The foreman fills out a slip, Fig. 5 and sends it to the rate setting department, as a notification that the material has been

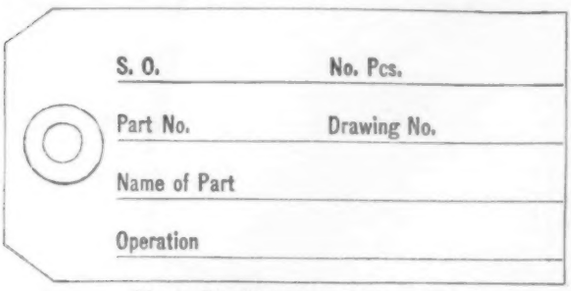


Fig. 4—The Work Identification Tag

delivered to the machine and the job is ready for manufacturing. If no time study is needed on this particular operation a bonus card, Fig. 6, is issued to the mechanic, containing all the required information—the time allowed per piece, the wage rate per hour, the operations to be performed and the time of starting the job. When the work is finished the bonus card is sent to the foreman of the department, who if no regular inspector is employed, inspects the work and verifies the number of pieces, and stamps the finishing time on the card and sends it to the cost department which figures the premium earned and enters the cost of the operation on the back of the card, Fig. 7.

If the job has never been done on bonus a detailed time study is made, and a rate card, Fig. 8, is made out containing the results and filed under the part number in the rate setting department. On its face are shown the operations, the time allowed per piece, the rate paid per hour, the cost per piece under both day work and bonus and a sketch of the part, showing operations. On the back of the card, Fig. 9, is a detailed time study of the different operations and the motions necessary to complete the work, from which data the standard time is computed. The studies are essential and are of value in proving to the workman that the bonus time is fair. The labor costs obtained from the bonus cards are posted direct to the individual piece cost sheets, Fig. 10, under the different operations, affording a correct and timely record of each operation immediately upon its conclusion. The addition of the items of material and overhead gives the total cost.

In setting the standard time great care must be taken, for when a time is once made it is understood by all that it will not be cut, unless entirely new methods of performing the work are introduced. In this way we have no trouble in obtaining the mechanic's best efforts. It often happens that a time study is made with the machine running at its proper speed and feed, and the employee doing his best work, with the result that the time is reduced almost one-half. The reason for this is that the mechanic bent upon making a bonus has carefully studied the situation and invented some little tool or fixture. In these cases he is given the full credit and the rate is never cut. Under piece work and similar systems, where a workman has improved methods of work and thereby overreached the maximum of output, determined by the rate setter, his reward is usually a cut, which is the main reason why they have not the popularity of bonus among workingmen. Under this system the mechanic is guaranteed his regular day's wage whether he makes the pieces in the time allowed or not, so he has absolutely nothing to lose, but all to gain.

Does Bonus Pay the Owner?

The question is often asked, "Does it really pay the manufacturer to install such a system, with the clerical force needed to run it?" This depends entirely on how elaborately he goes into it. That it has paid in this shop may be proved by a few concrete examples. Take for example the planing of cylinder head castings. The cost department's records showed that it required 120 min. to plane top and bottom. A time study showed that although the mechanic was running his planer at almost the maximum rate of speed and feed, he was losing considerable time in his methods of setting up and handling the work, and also that 12 heads could be put on the planer table at one time instead of 10 by using shorter clamps between the pieces. He was given two or more cutting tools, and instructed to have them reground as they became dull and not wait until all were dull and then stop his machine while he strolled over to the grinder and waited his turn at the wheel, as was formerly his habit.

After starting him off under normal conditions a time study was taken which showed that it required an average of but 57 min. 30 sec. per head instead of 120 min. A bonus card was issued allowing him 80 min. maximum and 40 min. minimum per piece, with 12 cents increase per hour if he reached the minimum, which he accomplished after a few attempts, his hourly wage rate increasing from 32 to 44 cents.

Now let us figure where the saving comes in. On day work it took an average of 120 min. to plane top and bottom of one casting, the man receiving 32 cents per hour, making a total cost of 64 cents for net labor per casting. Under the bonus plan we pay the mechanic 44 cents per hour, but the time is reduced to 40 min. per casting, which makes a total net labor cost of 29 cents. The mechanic increases his rate from 32 cents to 44 cents per hour, a

Please issue Bonus card

to No._____ Name _____

Operation _____

on Part No. _____ Shop Order No. _____

Time started _____ Date _____

_____ Foreman

Fig. 5—Notification to Rate Setting Department

38 per cent. higher wage. The company saves 80 min. per casting, or, in other words, the work is produced in one-third of the former time, cutting the cost to less than one-half, to say nothing of the economy in overhead. In another case we had an operation drilling 18¼-in. holes and cutting out 9 4-in. holes in a steel exhaust pipe shell. Under the old method this was a long, laborious task, as the holes had to be first laid out, marked and center punched, then drilled and cut with a number of

Part No. / Draw No.	**Bonus Card**	Order No.
Mechanic No.	Name	
Operation		Job Started
		Job Finished
		No. of Pcs. Finished
Time allowed per piece (Min.)	Rate allowed (Per Hrs.)	Guaranteed Wage Rate per Hour
		Work Delivered to
		Allowance
		Inspected by

Form 101.

Fig. 6—The Bonus Card

changes on a radial drilling machine, requiring about five hours' time. When this job was under consideration for bonus work it was found that the time could be materially reduced, if a suitable fixture for drilling was used.

Record

No. of Hours on Job

Credit for

Total Time

No. of Finished P a. No. Part Finished

Total Prem. Time per Pce.

Labor Cost per Pce.		
Shop Cost " "		
Prem. " "		
Total Cost per Pce.		

Fig. 7—The Record on the Back of Bonus Card

Such a tool with a special cutter was designed, figured to reduce the time to about one-half. The job was put on bonus and the result was that the work was finished in 90 min., at the same time greatly reducing the physical effort of the mechanic and increasing his wages about 25 per cent. The company, after deducting the cost of making the special fixture made a substantial saving on each shell.

The System Forces Co-operation

This system automatically forces the brains of the management to co-operate with the men of the shop, which relation is the secret of success in any business. Many more examples could be cited to show that bonus has proved its worth by lowering production costs and increasing wages and creating a greater efficiency throughout the establishment, but these are ample, I believe, to convince the skeptical manager that by its adoption he could manufacture his product to meet competition more successfully, and the hesitating mechanic that if he is willing to exercise his energies (which does not mean a greater increase of physical exertion in most cases, but simply a better co-operation of his brain and hands) he could better his financial condition.

Another question very often asked is, "How many of the men that work on the bonus plan actually earn bonuses? Is it only those who are experts in their particular lines?" It is a source of gratification to be able to show the chart, Fig. 11. It shows the progress of the bonus work for the year 1912. The wages are paid to the men at the end of the pay roll week, and the writer has kept a careful record of the number of jobs issued and what percentage earned bonuses. It can be seen from the chart that about 70 per cent. or three out of every four were included, and for all mechanics the average of bonus is about 27 per cent. higher wage.

This system has also greatly added to the efficiency of the cost department, which was at one time looked upon as a necessary evil, but now is the headquarters for all sorts of valuable information and timely records pertaining to the manufacturing end of the business. It reduces to a small percentage the errors made in machining, for the mechanic realizes that in order to earn his bonuses he must avoid mistakes which formerly resulted from his inattention. The system teaches him to rely more upon himself, thus reducing the work of the foreman. It shows the employer who are his efficient men.

TIME STUDY

No. 214 Name J. Johnson Rate 30

Machine No. 85 Kind L. S. lathe

	Min	Dec
Mark + drill centers	2	33
Rough outside of ends	9	28
" inside " "	4	—
" large half of Rod	4	45
" small " " "	2	42
Finish large " "	2	55
" small " " "	2	10
" fillet on ends	2	25
" inside of "	2	10
Cut ends to size	2	38
File + Polish end	1	40
Grind + change tools	18	—
Handling time	15	—
Total time	70-26	

Note — Time taken when done on Day's work 140 min each 10 Pcs.

Fig. 8—The Time Study Card

Form 186.

PART NO. E E 13

Turn face, center
Cut to size and finish
6 8 right
Connecting Rod

Lathe Job.

Job Rate 30¢

Time Allowed Per Piece	Day's Wage Per Piece	Cost Per Piece	Bonus Hour Rate
100 Min	.50	.50	.30
80 "	.40	.432	.323
70 "	.35	.399	.342
60 "	.30	.366	.366
50 "	.25	.33	.40
40 "	.20	.305	.46
10/5/08			

SKETCH

Fig. 9—The Rate and Instruction Card

The National Radiator Company, Johnstown, Pa., last week made a distribution of bonuses to about 50 of its employees, the amount being $1608. This was the fifth distribution of this kind by the company, the total now amounting to $10,420. Employees are given a percentage of their yearly wages, acording to the time they have been in the employ of the company. Those working two years receive 3 per cent. of their annual wages; those working three and four years, 4 per cent., and those working five years and more 5 per cent. The plan is reported to have had satisfactory results to both the company and the men.

New Railroad Building and Equipment

The annual statistical number of the Railway Age Gazette, which, as usual, contains exhaustive data bearing on American railroads, shows that in the calendar year 1912 there were completed 2997 miles of new main line, exclusive of second, third and fourth main tracks and side tracks, and further not including tracks laid in reconstruction work on main lines. The number of miles given compares with 3066 completed last year and 4122 in 1910, while the average for 19 years prior to 1912 was 3842 miles. Completed new construction last year was the lowest since 1897, when 2109 miles were built. At present there are 2500 miles of new line under construction in the United States and 2800 miles additional are definitely projected. New line mileage completed in Canada in 1912 totaled 2232 miles, as compared with 1898 miles in 1911. In Mexico only 212 miles were built, as compared with 351 in 1911, the falling off being a reflection of that country's political disturbances. The following is a record of mileage constructed in the United States in the past 20 years:

	Miles		Miles		Miles
1893	3,024	1900	4,894	1907	5,212
1894	1,760	1901	5,368	1908	3,214
1895	1,428	1902	6,026	1909	3,748
1896	1,692	1903	5,652	1910	4,122
1897	2,109	1904	3,832	1911	3,066
1898	3,265	1905	4,388	1912	2,997
1899	4,569	1906	5,623		

Car and Locomotive Building

Statistics from the same journal show that while car and locomotive building increased in 1912 as compared with 1911, comparison with other years is not so favorable, it being pointed out that the 1912 total was exceeded in five of the last 14 years. From returns received from railroad shops and builders it is ascertained that 152,429 freight cars were built in 1912, as compared with 72,161 in 1911; 3060 passenger cars, as compared with 4246 in 1911; 4915 locomotives in 1912, as compared with 3530 in 1911. Under the influence of big crop indications and an already existing car shortage, heavy orders were placed for cars and continued as long as fall delivery could be promised, after which there came more normal conditions, with a revival of heavier orders in October and November. Of the freight cars built in 1912, 148,357 were for domestic service and 4072 for export; of the passenger cars 2822 were for domestic service and 238 for export.

Of the freight cars, 66,250 were of all-steel construction or had steel underframes; 18,576 were of wood, while 67,603 were not specified. Of the passenger cars 1418 were all-steel or with steel underframes, 745 were of wood, 897 were not specified, and 215 were electric or subway cars.

The following table shows the cars built in the past 14 years:

Year	Freight	Passenger	Total
1899	119,886	1,305	121,191
1900	115,631	1,636	117,267
1901	136,950	2,055	139,005
1902	162,599	1,948	164,547
1903	153,195	2,007	155,202
1904	60,806	2,144	62,950
1905*	165,155	2,551	168,006
1906*	240,503	3,167	243,670
1907*	284,188	5,457	289,645
1908*	76,555	1,716	78,271
1909*	93,570	2,849	96,419
1910*	180,945	4,412	185,357
1911*	72,161	4,246	76,407
1912†	152,429	3,060	155,489

*Includes Canadian output.
†Includes Canadian output and equipment built in railroad shops.

In the year 1912 there were built 4915 locomotives, as shown by returns received. Of the total 4403 were for domestic service and 512 for export. The record for 20 years in locomotive building follows:

Year	No. Built	Year	No. Built	Year	No. Built
1893	2,011	1900	3,153	1906*	6,952
1894	695	1901	3,384	1907*	7,362
1895	1,101	1902	4,070	1908*	2,342
1896	1,175	1903	5,152	1909*	2,887
1897	1,251	1904	3,441	1910*	4,755
1898	1,875	1905*	5,491	1911*	3,530
1899	2,475			1912†	4,915

*Includes Canadian output.
†Includes Canadian output and equipment built in railroad shops.

Number and Types of Cars Ordered

The number of freight cars ordered in 1912 was 234,758 and the number of passenger cars 3642.. Since the journal referred to began keeping these records in 1901, the number of freight cars ordered in 1912 has been exceeded only twice—in 1905 and 1906, when 341,315 and 310,315 were ordered respectively. Passenger cars ordered in 1912 were exceeded in number only twice also—in 1909 and 1910, when they were 4514 and 3881, respectively.

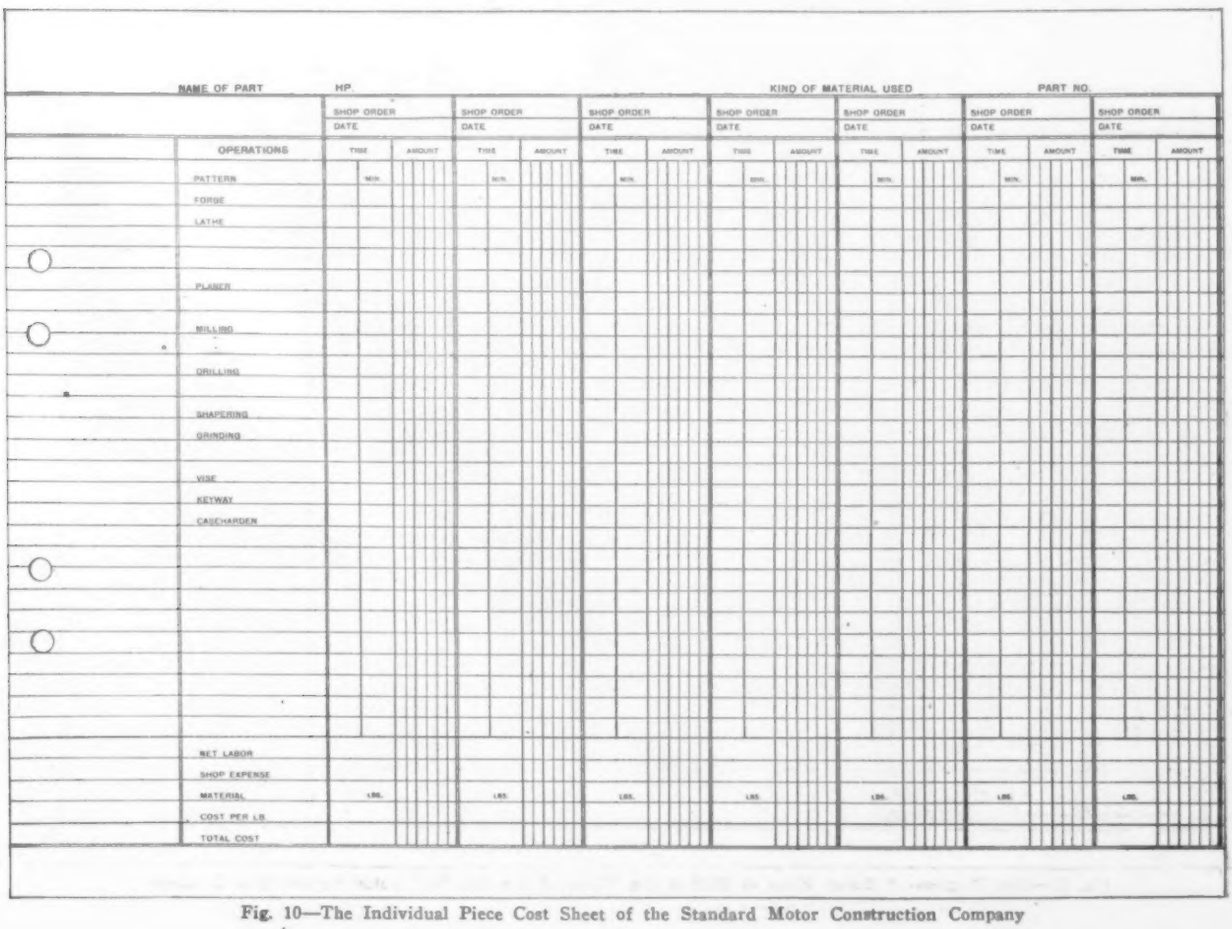
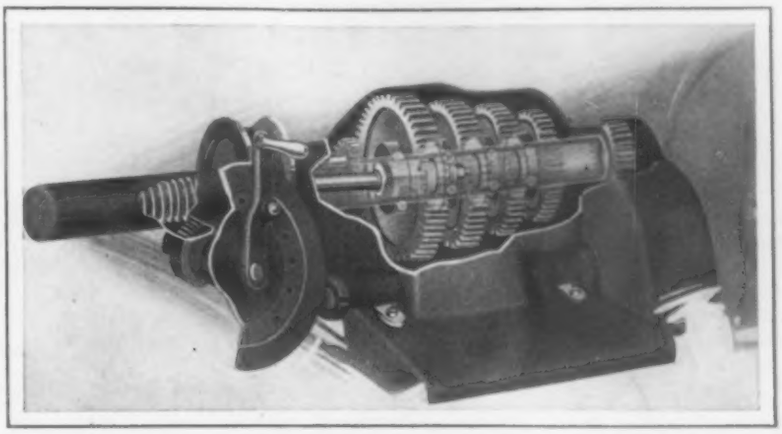


Fig. 10—The Individual Piece Cost Sheet of the Standard Motor Construction Company

All Geared Head Stock for Grinders

The Modern Tool Company, Erie, Pa., has equipped its No. 18 plain grinding machine with a head stock of the all geared type. As will be seen in the illustration, eight different speeds are procured by the action of a lever which operates as a plunger and hardened steel balls which make the connection between the gears to give the desired speed on the shaft. The changes can be made while the machine is running, as there are no keys or pins to shear off. Between each speed is a neutral point, enabling work to be stopped by simply bringing the lever to that position. The driving pulley is located on the end of the head stock, so that it does not interfere with the placing or removing of work. The pin for driving work on the dead centers is adjustable on the driving plate for taking different sizes of work dogs. The head stock is fitted to the swivel table by vee and flat ways and is kept in position by a hooked clamp bolt, which holds it very rigidly. All head stock gears run in oil. The work speeds and the table feeds are separate, so that any required combination of speeds can be obtained.



Geared Head of the Modern Tool Company's Grinding Machine

J. E. Ferguson, vice-president Lackawanna Bridge Company, Buffalo, N. Y., in charge of the contracting and sales department, resigned January 1 and has organized a new company to be known as the Ferguson Steel & Iron Company, with headquarters at Buffalo. This company, of which Mr. Ferguson will be president, will specialize in the jobbing and fabricating of structural steel and will establish a warehouse and fabricating plant for that purpose in Buffalo. Prior to his connection with the Lackawanna Bridge Company, which has extended over the past two years, he was engaged with Joseph T. Ryerson & Son, Chicago, with whom he held a prominent position in the management of sales for about 10 years.

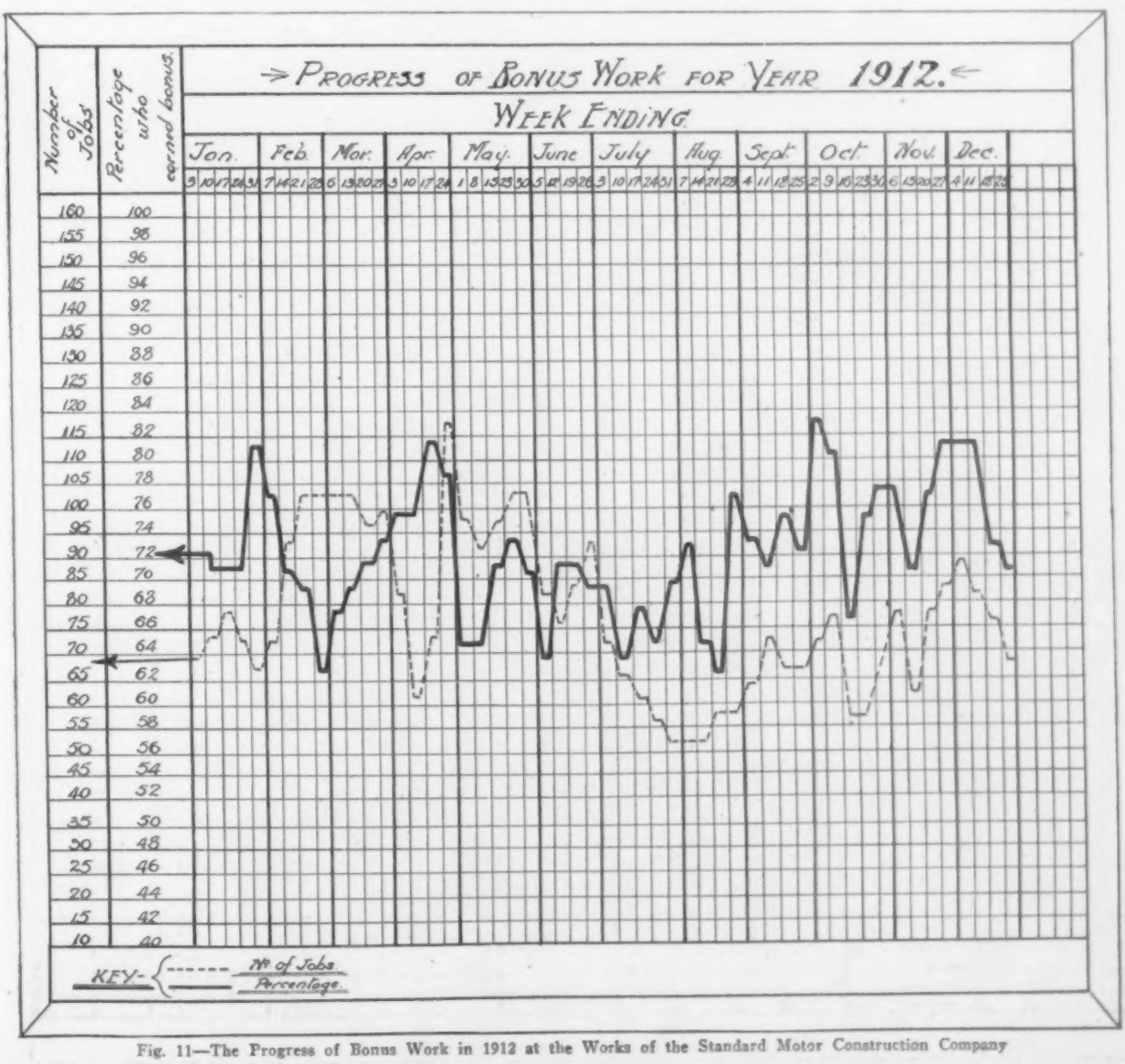


Fig. 11—The Progress of Bonus Work in 1912 at the Works of the Standard Motor Construction Company

Metal, Tin Plate and Sheet Prices for 15 Years

Monthly Averages Computed from the Weekly Market Quotations of "The Iron Age" in the Period 1898-1912

(With Supplement.)

The accompanying supplement shows by plotted lines the fluctuations in prices of the more important metals, tin plates and sheets in the period from 1898 to 1912, inclusive. The prices used for this purpose are the computed monthly averages of the prices of carloads, at New York, for metals and at Pittsburgh for tin plate and No. 28 black steel sheets, given in the metal market reports of *The Iron Age* week by week. The columns of figures alongside the chart give the values. The column nearest the chart gives tin in cents per pound; the middle column, copper in cents per pound, and the outside column represents lead, spelter and steel sheets in cents per pound and tin plate in dollars per base box. The following tables give the monthly averages on which the chart is based:

Lake Copper, at New York, in Cents per Pound.

Months	1898	1899	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912
January	11.00	14.02	16.21	16.90	11.45	12.13	12.62	15.18	18.78	24.41	13.90	14.56	14.00	12.81	14.50
February	11.19	17.66	16.25	16.97	12.47	12.80	12.34	15.25	17.94	25.10	13.13	13.37	13.78	12.75	14.41
March	11.95	17.55	16.41	17.00	12.12	14.31	12.60	15.25	18.50	23.38	12.85	12.90	13.75	12.58	14.88
April	12.05	18.56	17.00	17.00	11.97	14.85	13.19	15.18	18.62	24.62	13.09	12.94	13.31	12.41	16.00
May	12.04	18.65	16.80	17.00	12.10	14.75	13.28	15.00	18.70	24.10	12.88	13.21	13.06	12.33	16.30
June	11.85	18.20	16.31	17.00	12.23	14.56	12.74	15.00	18.69	23.94	13.00	13.50	12.88	12.71	17.53
July	11.59	18.37	16.31	16.97	11.94	13.73	12.62	15.03	18.47	21.95	13.00	13.34	12.66	12.78	17.54
August	11.85	18.50	16.55	16.50	11.59	13.35	12.50	16.07	18.65	18.94	13.71	13.56	12.93	12.75	17.73
September	13.25	18.47	16.75	16.50	11.60	13.58	12.67	16.12	19.31	16.41	13.80	13.50	12.81	12.65	17.77
October	12.37	18.03	16.73	16.71	11.71	13.42	13.09	16.62	21.81	13.80	13.81	13.19	12.84	12.53	17.80
November	12.69	17.00	16.75	16.82	11.44	13.25	14.22	16.90	22.50	13.94	14.44	13.44	12.98	12.80	17.70
December	12.79	16.69	16.87	14.71	11.61	12.30	14.87	18.75	23.06	13.48	14.53	13.80	13.00	13.84	17.68

Spelter, at New York, in Cents per Pound.

January	3.75	4.90	4.55	4.08	4.28	4.82	4.95	6.17	6.48	6.90	4.54	5.15	6.26	5.55	6.52
February	3.79	5.68	4.69	3.94	4.18	5.00	4.95	6.12	6.09	7.00	4.78	4.99	5.89	5.56	6.71
March	4.00	5.99	4.60	3.89	4.29	5.36	5.05	6.06	5.96	6.92	4.76	4.81	5.72	5.65	6.98
April	4.00	6.25	4.71	3.94	4.41	5.65	5.22	5.97	6.05	6.81	4.68	4.94	5.60	5.51	6.86
May	3.95	6.72	4.52	3.97	4.50	5.75	5.14	5.55	5.95	6.51	4.60	5.12	5.20	5.50	6.86
June	4.65	6.02	4.27	3.95	4.88	6.00	4.79	5.32	6.14	6.45	4.56	5.39	5.19	5.63	6.99
July	4.51	5.79	4.24	3.90	5.23	5.95	4.85	5.38	5.98	6.15	4.46	5.35	5.20	5.79	7.26
August	4.35	5.55	4.17	3.92	5.46	5.94	4.85	5.66	6.06	5.71	4.71	5.74	5.26	6.04	7.19
September	4.62	5.40	4.10	4.02	5.45	6.00	5.06	5.83	6.19	5.28	4.76	5.85	5.53	6.03	7.53
October	4.61	5.37	4.10	4.20	5.48	6.05	5.17	6.05	6.18	5.45	4.81	6.09	5.69	6.20	7.57
November	5.09	4.64	4.20	4.32	5.29	5.68	5.49	6.17	6.36	5.10	5.03	6.32	5.95	6.60	7.48
December	5.13	4.68	4.19	4.35	4.91	5.15	5.80	6.50	6.62	4.39	5.17	6.35	5.80	6.44	7.34

Lead, at New York, in Cents per Pound.

January	3.66	4.02	4.70	4.37	4.02	4.10	4.39	4.56	5.86	6.30	3.73	4.19	4.70	4.50	4.41
February	3.69	4.53	4.70	4.37	4.10	4.10	4.40	4.50	5.56	6.31	3.75	4.07	4.63	4.46	4.00
March	3.71	4.37	4.70	4.37	4.10	4.44	4.50	4.45	5.35	6.31	3.88	4.02	4.51	4.41	4.08
April	3.61	4.30	4.70	4.37	4.10	4.59	4.50	4.50	5.39	6.16	4.02	4.19	4.40	4.44	4.20
May	3.64	4.42	4.22	4.37	4.10	4.37	4.48	4.50	5.90	6.02	4.26	4.32	4.37	4.40	4.20
June	3.86	4.45	3.90	4.37	4.10	4.25	4.22	4.51	5.94	5.75	4.45	4.36	4.38	4.46	4.50
July	3.95	4.55	4.03	4.37	4.10	4.12	4.17	4.56	5.80	5.24	4.50	4.35	4.40	4.50	4.67
August	3.99	4.56	4.26	4.37	4.10	4.12	4.15	4.64	5.78	5.12	4.59	4.36	4.40	4.50	4.54
September	3.99	4.60	4.36	4.37	4.10	4.26	4.20	4.85	5.92	4.84	4.54	4.39	4.40	4.49	5.04
October	3.81	4.59	4.37	4.37	4.10	4.40	4.20	5.07	5.94	4.64	4.34	4.39	4.40	4.31	5.06
November	3.70	4.58	4.37	4.37	4.10	4.25	4.51	5.48	5.97	4.45	4.39	4.40	4.44	4.31	4.66
December	3.62	4.65	4.37	4.19	4.10	4.19	4.60	5.96	6.19	3.76	4.24	4.56	4.50	4.45	4.35

Tin, at New York, in Cents per Pound.

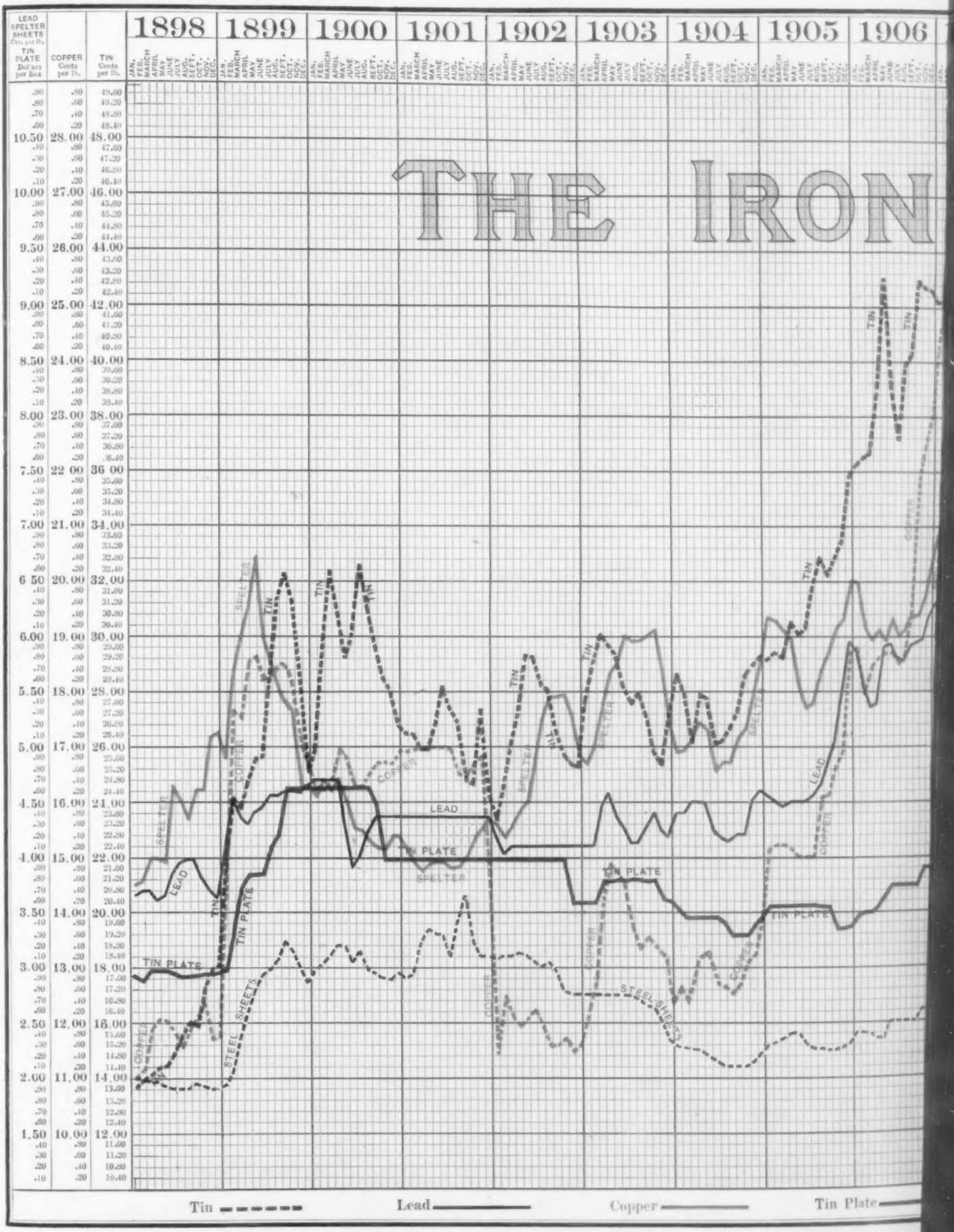
January	13.77	22.12	26.00	26.60	23.38	27.76	28.75	29.18	36.36	42.14	27.43	28.19	32.61	41.20	44.58
February	14.04	24.25	29.71	26.55	24.73	29.14	27.98	29.49	36.48	42.16	28.74	28.44	32.65	43.34	43.56
March	14.26	23.86	32.42	25.95	26.16	30.06	26.19	29.21	36.62	41.29	30.46	28.75	32.51	41.10	42.76
April	14.41	24.82	30.85	25.94	27.29	29.69	27.99	30.43	38.86	40.84	31.79	29.35	32.83	42.05	43.64
May	14.54	25.61	29.25	26.82	29.26	29.36	27.76	30.04	43.08	43.01	29.84	29.07	33.05	43.32	45.98
June	15.05	25.69	30.00	28.22	29.29	28.30	26.14	30.36	38.97	42.65	28.18	29.26	32.79	46.25	47.44
July	15.60	28.72	32.76	27.41	28.28	27.60	26.28	31.71	37.18	41.15	28.92	29.05	32.99	43.23	44.70
August	16.14	31.40	31.13	26.90	28.14	28.00	26.74	32.85	39.90	37.35	29.99	29.96	33.92	43.38	45.86
September	16.02	32.40	29.63	25.04	26.55	27.06	27.27	32.21	40.32	37.22	28.91	30.00	35.17	39.69	49.16
October	17.25	31.35	28.46	24.62	25.76	25.83	28.53	32.47	42.90	32.33	29.44	30.41	36.76	41.23	50.07
November	18.07	28.52	28.10	27.47	25.43	25.35	29.00	33.46	42.70	30.81	30.43	30.74	37.38	43.08	49.87
December	18.20	25.19	26.84	24.39	25.33	27.53	29.27	35.84	42.62	27.92	29.13	32.91	38.21	45.03	49.08

Tin Plate, at Pittsburgh, in Dollars per Box.

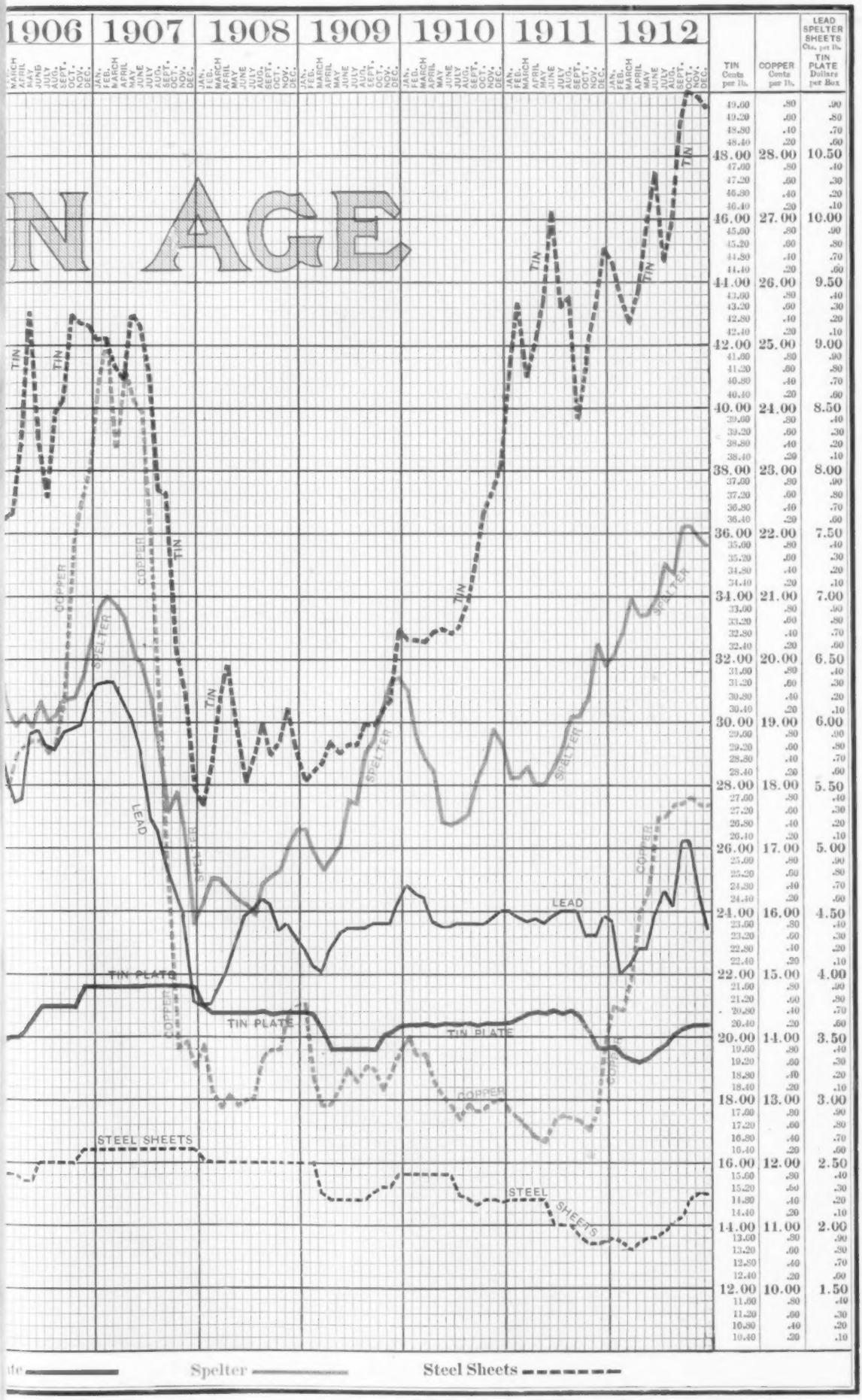
January	$2.95	$3.00	$4.65	$4.00	$4.00	$3.60	$3.56	$3.55	$3.47	$3.90	$3.74	$3.70	$3.60	$3.60	$3.40
February	2.90	3.38	4.65	4.00	4.00	3.60	3.45	3.55	3.50	3.90	3.70	3.70	3.60	3.67	3.35
March	3.00	3.75	4.65	4.00	4.00	3.80	3.45	3.55	3.50	3.90	3.70	3.53	3.60	3.70	3.30
April	3.00	3.87	4.65	4.00	4.00	3.80	3.45	3.55	3.57	3.90	3.70	3.40	3.60	3.70	3.30
May	3.00	3.87	4.65	4.00	4.00	3.80	3.45	3.55	3.66	3.90	3.70	3.40	3.60	3.70	3.33
June	2.99	3.87	4.65	4.00	4.00	3.80	3.45	3.55	3.75	3.90	3.70	3.40	3.60	3.70	3.40
July	2.94	4.12	4.65	4.00	4.00	3.80	3.41	3.55	3.75	3.90	3.70	3.40	3.60	3.70	3.43
August	2.93	4.23	4.65	4.00	4.00	3.80	3.30	3.55	3.75	3.90	3.70	3.40	3.60	3.70	3.50
September	2.98	4.65	4.50	4.00	4.00	3.80	3.30	3.55	3.75	3.90	3.70	3.40	3.60	3.67	3.58
October	2.98	4.65	4.00	4.00	4.00	3.80	3.30	3.34	3.75	3.90	3.70	3.50	3.60	3.52	3.60
November	2.98	4.65	4.00	4.00	3.60	3.65	3.39	3.34	3.90	3.90	3.70	3.56	3.60	3.40	3.60
December	3.00	4.65	4.00	4.00	3.60	3.60	3.47	3.40	3.90	3.90	3.70	3.60	3.60	3.40	3.60

No. 28 Black Steel Sheets, at Pittsburgh, in Cents per Pound.

January	2.02½	1.92½	2.97½	2.90	3.07½	2.75	2.29	2.30	2.40	2.60	2.52	2.50	2.40	2.20	1.90
February	2.00	2.05	3.03	2.93¾	3.10	2.75	2.27½	2.30	2.40	2.60	2.50	2.50	2.40	2.20	1.87
March	1.96	2.36	3.10	3.22½	3.10	2.75	2.27	2.34	2.38	2.60	2.50	2.25	2.40	2.20	1.80
April	1.97½	2.60	3.20	3.35	3.12½	2.75	2.25	2.40	2.35	2.60	2.50	2.20	2.40	2.20	1.86
May	1.92½	2.78¾	3.20	3.30	3.10	2.75	2.20	2.40	2.35	2.60	2.50	2.20	2.40	2.20	1.90
June	1.90	2.93	3.05	3.30	3.05	2.75	2.16	2.30	2.50	2.60	2.50	2.20	2.40	2.00	1.90
July	1.90	2.97½	3.14¾	3.10	3.00	2.73¾	2.10	2.26	2.50	2.60	2.50	2.20	2.23¾	2.00	1.95
August	1.90	3.08	2.98	3.41	3.05	2.70	2.10	2.26	2.50	2.60	2.50	2.20	2.21	1.99	2.02
September	1.96	3.22½	2.93¾	3.77½	2.97½	2.65	2.10	2.25	2.50	2.60	2.50	2.26	2.15	1.91	2.07
October	1.92	3.15	2.90	3.23	2.79	2.62	2.10	2.25	2.50	2.60	2.50	2.30	2.20	1.85	2.21
November	1.90	3.00	2.89	3.10	2.75	2.49	2.12½	2.27	2.60	2.60	2.50	2.30	2.20	1.85	2.25
December	1.90	2.87½	2.96	3.10	2.75	2.32	2.22	2.30	2.60	2.60	2.50	2.40	2.19	1.83¾	2.25



Fluctuations in Carload Prices of Lake Copper, Lead, Tin
No. 28 Black Steel Sheets in Pittsburgh from Ja



TIN Cents per lb.	COPPER Cents per lb.	LEAD SPELTER SHEETS Cts. per lb. TIN PLATE Dollars per Box
49.60	.80	.90
49.20	.60	.80
48.80	.40	.70
48.40	.20	.60
48.00	**28.00**	**10.50**
47.60	.80	.40
47.20	.60	.30
46.80	.40	.20
46.40	.20	.10
46.00	**27.00**	**10.00**
45.60	.80	.90
45.20	.60	.80
44.80	.40	.70
44.40	.20	.60
44.00	**26.00**	**9.50**
43.60	.80	.40
43.20	.60	.30
42.80	.40	.20
42.40	.20	.10
42.00	**25.00**	**9.00**
41.60	.80	.90
41.20	.60	.80
40.80	.40	.70
40.40	.20	.60
40.00	**24.00**	**8.50**
39.60	.80	.40
39.20	.60	.30
38.80	.40	.20
38.40	.20	.10
38.00	**23.00**	**8.00**
37.60	.80	.90
37.20	.60	.80
36.80	.40	.70
36.40	.20	.60
36.00	**22.00**	**7.50**
35.60	.80	.40
35.20	.60	.30
34.80	.40	.20
34.40	.20	.10
34.00	**21.00**	**7.00**
33.60	.80	.90
33.20	.60	.80
32.80	.40	.70
32.40	.20	.60
32.00	**20.00**	**6.50**
31.60	.80	.40
31.20	.60	.30
30.80	.40	.20
30.40	.20	.10
30.00	**19.00**	**6.00**
29.60	.80	.90
29.20	.60	.80
28.80	.40	.70
28.40	.20	.60
28.00	**18.00**	**5.50**
27.60	.80	.40
27.20	.60	.30
26.80	.40	.20
26.40	.20	.10
26.00	**17.00**	**5.00**
25.60	.80	.90
25.20	.60	.80
24.80	.40	.70
24.40	.20	.60
24.00	**16.00**	**4.50**
23.60	.80	.40
23.20	.60	.30
22.80	.40	.20
22.40	.20	.10
22.00	**15.00**	**4.00**
21.60	.80	.90
21.20	.60	.80
20.80	.40	.70
20.40	.20	.60
20.00	**14.00**	**3.50**
19.60	.80	.40
19.20	.60	.30
18.80	.40	.20
18.40	.20	.10
18.00	**13.00**	**3.00**
17.60	.80	.90
17.20	.60	.80
16.80	.40	.70
16.40	.20	.60
16.00	**12.00**	**2.50**
15.60	.80	.40
15.20	.60	.30
14.80	.40	.20
14.40	.20	.10
14.00	**11.00**	**2.00**
13.60	.80	.90
13.20	.60	.80
12.80	.40	.70
12.40	.20	.60
12.00	**10.00**	**1.50**
11.60	.80	.40
11.20	.60	.30
10.80	.40	.20
10.40	.20	.10

, Tin and Spelter in New York and Tin Plate and
om January 1, 1898, to January 1, 1913

Cast Iron Pipe Prices from 1900 to 1912

The accompanying diagram, partly furnished by Daniel Runkle, of the Warren Foundry & Machine Company, 111 Broadway, New York, shows the course of prices for the past 13 years on 6-in. cast iron water pipe, 30 lb. per ft., f.o.b. New York City, in carload lots, per ton of 2000 lb. For those who desire the data on which the pipe curve is constructed, the following average monthly prices are presented by Mr. Runkle:

Cast Iron Pipe Prices at New York, 6 Inch, Per Net Ton

	1900	1901	1902	1903	1904	1905	1906
January	$27.50	$21.75	$24.50	$29.25	$24.50	$28.00	$29.75
February	26.75	22.25	25.00	29.25	24.25	28.50	29.50
March	26.75	21.50	26.25	30.75	24.25	26.75	30.50
April	26.50	22.00	26.00	31.00	24.25	27.00	29.75
May	26.00	22.25	27.75	30.75	24.00	27.25	31.00
June	24.50	23.00	28.00	30.75	23.50	27.25	32.50
July	24.75	23.75	28.50	30.75	23.50	27.25	30.25
August	23.50	23.75	29.50	29.50	23.50	27.75	30.50
September	22.25	23.50	29.50	29.00	23.00	27.25	31.00
October	21.75	24.00	29.50	26.00	23.25	28.25	33.00
November	21.75	24.50	30.75	24.50	25.00	29.00	33.25
December	21.75	23.75	29.25	24.25	27.00	29.25	35.50

	1907	1908	1909	1910	1911	1912
January	$34.25	$27.00	$24.50	$24.75	$24.75	$24.50
February	34.25	26.75	24.25	25.50	24.00	24.50
March	34.00	26.25	25.25	26.00	23.75	24.00
April	33.50	26.25	25.00	26.75	23.50	23.75
May	34.25	26.25	25.25	27.50	24.50	23.25
June	33.50	25.75	26.00	27.00	24.50	23.50
July	34.00	25.75	26.25	27.00	24.25	23.75
August	32.50	25.25	26.00	26.50	24.00	24.00
September	33.00	25.75	25.75	25.00	24.00	24.50
October	33.50	25.75	25.50	24.75	24.00	25.00
November	28.50	25.00	27.00	23.50	24.00	26.50
December	28.00	25.50	27.25	22.75	23.50	27.25

To show how closely cast iron pipe prices follow the fluctuations in pig iron, we have added to the pipe curve another giving the course of prices on gray forge pig iron at Philadelphia and vicinity, as gray forge is largely used in making pipe. The prices on which this curve is constructed have been averaged from weekly prices in *The Iron Age* and are as follows:

Gray Forge Pig Iron Prices at Philadelphia and Vicinity, Gross Ton

	1900	1901	1902	1903	1904	1905	1906
January	$20.37½	$14.50	$15.75	$21.75	$13.50	$16.25	$16.75
February	20.25	14.50	15.75	21.25	13.50	15.75	17.00
March	19.25	14.00	17.50	20.00	12.75	16.25	16.75
April	18.75	14.37½	18.25	20.00	13.75	16.25	16.75
May	18.00	14.37½	19.00	19.50	13.75	16.00	16.50
June	16.50	14.37½	19.25	18.25	13.50	15.75	16.25
July	14.50	14.12½	21.75	18.12½	13.25	14.50	16.10
August	14.50	14.00	21.00	15.50	12.50	15.00	16.50
September	14.00	14.00	21.00	14.75	13.00	15.00	17.75
October	13.50	14.12½	21.00	14.50	12.75	15.75	18.25
November	14.00	14.37½	22.00	14.00	14.00	16.25	20.00
December	14.50	14.87½	22.25	14.00	15.50	16.50	22.00

	1907	1908	1909	1910	1911	1912
January	$23.50	$16.50	$16.25	$17.75	$14.25	$14.25
February	23.50	16.50	16.25	17.50	14.25	14.25
March	23.50	16.50	15.50	16.90	14.60	14.25
April	23.00	16.00	15.00	16.62	14.75	14.37½
May	23.25	16.00	15.00	16.00	14.70	14.50
June	23.00	15.25	15.25	15.65	14.50	14.62½
July	22.50	15.25	15.50	15.37½	14.50	14.87½
August	20.25	15.25	16.25	15.00	14.30	15.37½
September	19.50	15.50	17.00	14.75	14.45	15.87½
October	18.75	15.50	17.50	14.50	14.25	16.87½
November	17.00	15.75	18.00	14.37½	14.25	17.62½
December	16.75	16.00	18.00	14.25	14.25	17.75

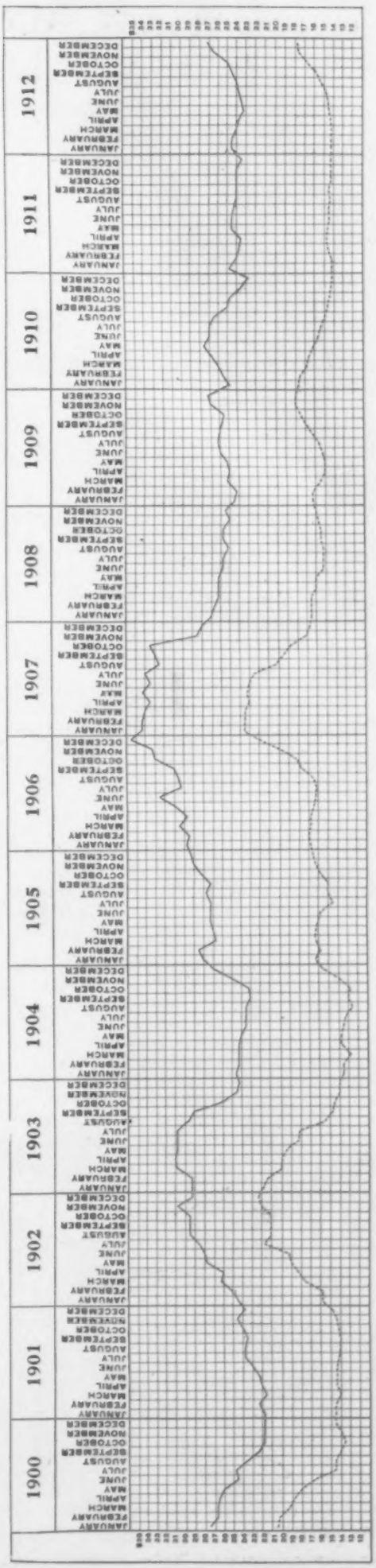


Diagram Showing the Course of Prices of Cast Iron Water Pipe at New York City for the Past Thirteen Years, Compared with the Course of Prices on Gray Forge Pig Iron at Philadelphia. The Pipe is 6-Inch, Weighing 30 Pounds to the Yard, Carload Lots, Priced per Ton of 2000 Pounds. The Heavy Black Line Indicates the Pipe Prices and the Dotted Line the Pig Iron Prices

October Sprinkler Fires

The report of the Boston Manufacturers' Mutual Fire Insurance Company covering fires in the month of October shows a total of 67 with a loss of $30,133, or an average of $450 per fire. Fifty-two of the fires were in properties protected by Grinnell automatic sprinklers, the total loss in these fires being $10,543, or an average of only $201 per fire. The remaining 15 fires accounted for a loss of $19,680, or an average of $1,312 per fire.

The largest fire on the list was in a paper mill which was being partially rebuilt. The sprinkler system was not in operation, for the tank was practically empty and the valves for filling it were closed. Many sprinklers opened and the water which was in the pipes was quickly drained out, after which the sprinklers were of no more use. The lesson of this is very clearly the necessity for keeping sprinkler systems always in shape for operation under whatever circumstances may arise. Fire always hits when least expected, and this is simply one more instance to prove the fact.

The Manufacture of Electrical Sheets

Core Losses Now Considerably Reduced and Hard and Brittle Steel Is Preferred to Soft Material

BY JOHN G. HOMAN*

The year 1912 ends with a production of approximately 120,000 tons of sheet steel known as electrical sheets. The quantity mentioned does not include the entire amount of sheet steel used in the electrical industry, such as deep-stamping, nickeling, japanning, blued material, etc.

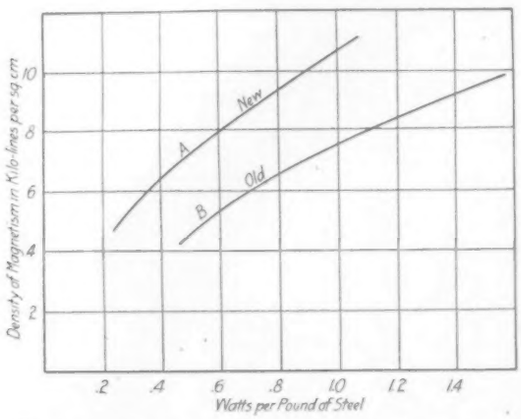


Fig. 1.—Core Loss for Old and New Products, 60 Cycles

Electrical sheets are those which are punched up into flat laminæ to form the magnetic paths for dynamos, motors, transformers, etc.

Wherever in a dynamo machine the magnetism is subject to variation, as in the armature of a motor or core of a transformer, the iron path containing that magnetism must be built up of thin laminæ cut from sheet material. In alternating current electrical apparatus especially, the iron parts of the magnetic circuits are subject to changing magnetic forces and invariably require considerable lamination. It thus happens that the enormous increase in the use of alternating current for the economic transmission of electrical energy over long distances has caused a marked demand for electrical sheets. To appreciate this growth, it may be stated that in 1902 the largest alternating current transformer was of less than 2000 kw. capacity and the highest voltage used for transmission was about 80,000 volts. To-day, transformers of 14,000 kw. capacity are in use and the maximum voltage has risen to 140,000. The transformer data are criterion for the development of the electrical machinery in general.

Since the sheet steel intended for this work is neither drawn into intricate forms nor subjected to undue stresses, it follows that the mechanical properties are not the important ones. It is true that the material should be clean and of uniform thickness; clean because of the cutting dies, and uniform in gauge because it is desired, in the completed laminated structure, to get in as much iron as possible. The important considerations are magnetic and electrical.

When an armature rotates and is thus under the influence of a constantly changing magnetism, then the iron laminæ through which the flux of magnetism passes has a tendency to heat. The heat developed in a given machine, in this way, is greatly influenced by the quality of electrical sheets used in making the armature core of that machine. As heat is energy and as the heat developed satisfies no useful function, it is regarded as loss and subtracts just so much from the efficiency of the machine. The loss is called "core loss" or "iron loss."

Fifteen years ago it was next to impossible to get definite data regarding sheet steel for dynamos, etc., and the softness of the particular material was regarded as a sure index to its goodness, where core losses were concerned. Hard and brittle materials were discarded. It now happens that the very best material obtainable is hard and brittle, containing from 3 to 4 per cent. silicon.

The manufacturers of electrical sheets of recognized quality now issue a guaranty with their materials, stating precisely just what the core losses may be. Fig. 1 represents the core loss data for two different steels. Curve A is for material obtainable now, while curve B is for what was likely the best obtainable ten years ago. The curves express core loss as a function of the magnetic density (or magnetic volume flowing through the iron) at a frequency of 60 cycles per second. It will be noted that curve A indicates material approximately 45 per cent. lower in core losses than curve B. The core losses are measured in watts and given in terms of "watts per pound" of core material, which is a rate of energy expenditure equivalent to 1/746 hp. per pound of iron laminæ.

To appreciate what iron loss of energy means in dollars and cents, consider a 500 kw. transformer. Its core losses will amount to 7.5 kw., no matter what load the apparatus is carrying. In one year of continuous operation the total energy expended as useless and damaging

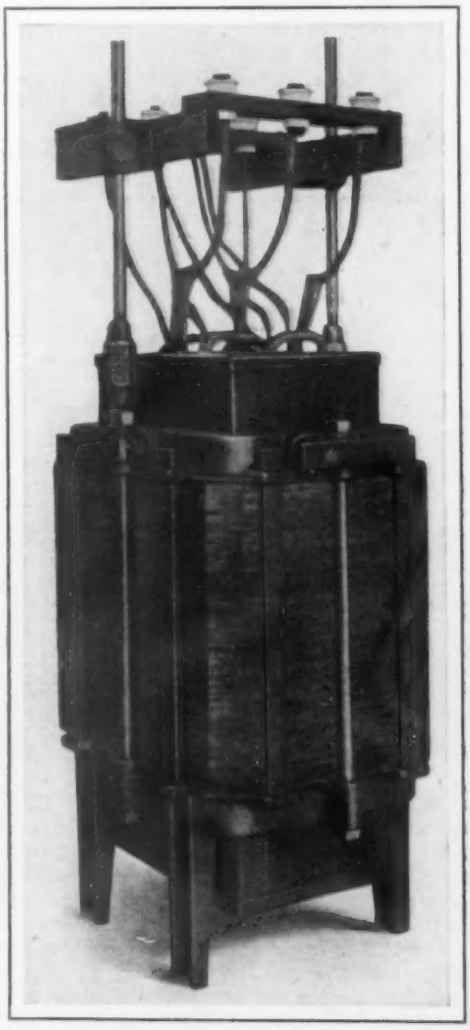


Fig. 2.—Core and Coils of a Large Transformer

heat in this instance will be 65,700 kw.-hours, which at 2c. per kw.-hour is $1,314, or an amount sufficient to pay 10 per cent. on the investment required to buy three such transformers.

There is room for considerable improvement in the future. Steels have been already produced quite superior

*Engineer magnetic department Follansbee Brothers Company.

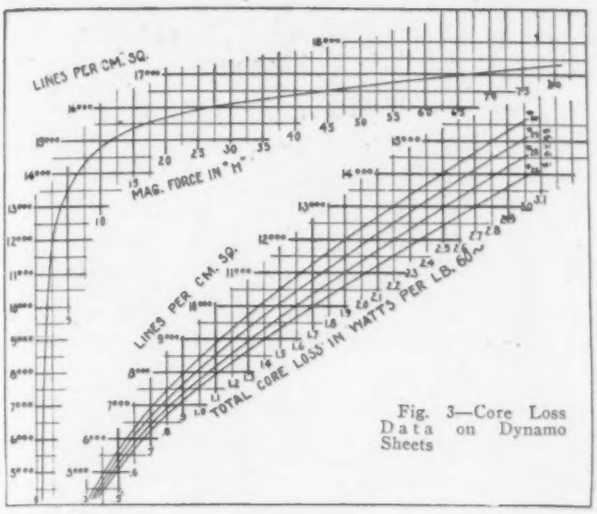


Fig. 3—Core Loss Data on Dynamo Sheets

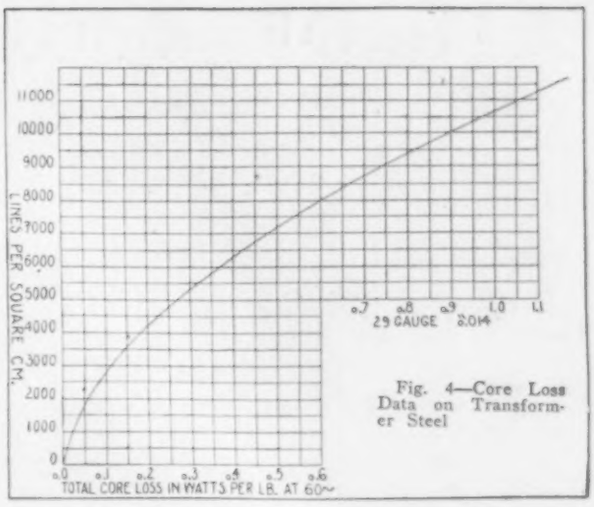


Fig. 4—Core Loss Data on Transformer Steel

to that indicated in Fig. 1, curve A, but in experimental quantities only. Careful study of heat treatments, casting methods and temperatures, gas elimination, accurate annealing, etc., will no doubt bring satisfactory reward to those who give the necessary time and money to it. In Fig. 2 is shown the internal structure of a large transformer. The core will give some idea of the quantity of steel used in such laminated structures. Fig. 3 reproduces the guaranty data of one concern covering its dynamo sheets.

Fig. 4 reproduces guaranty data for high quality transformer steel.

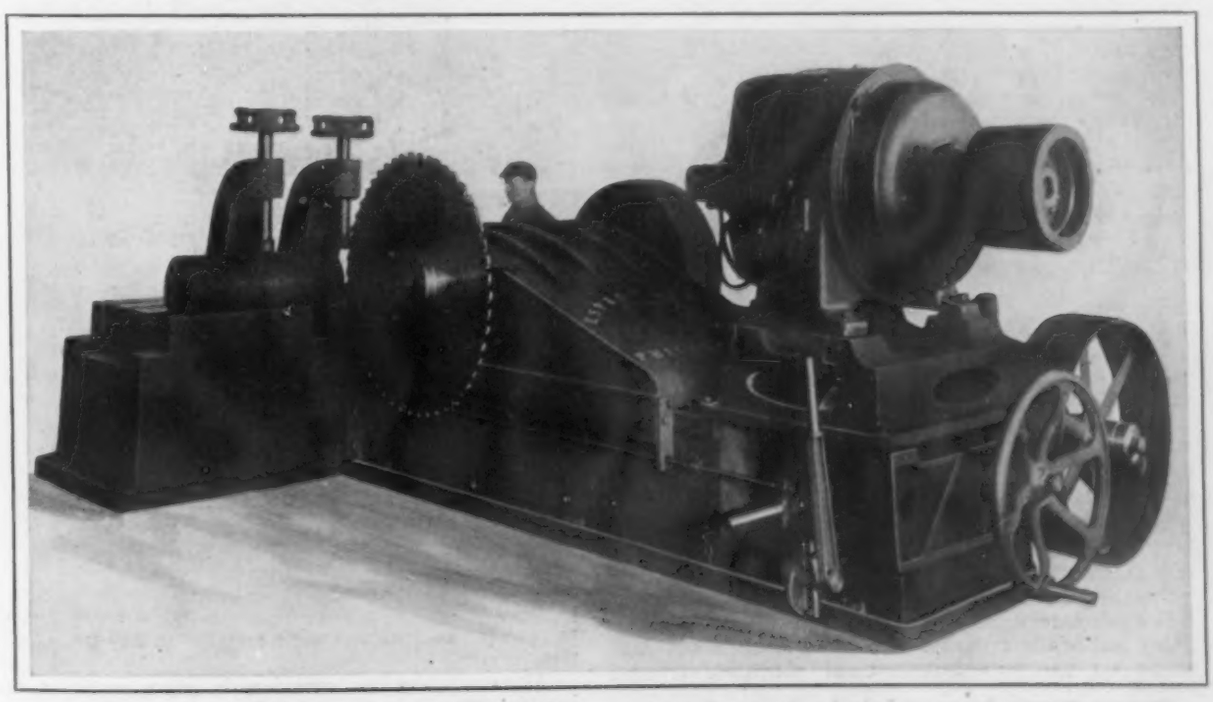
Heavy Cold Saw Cutting Off Machine

The rapid production cold saw cutting off machine here illustrated is one of a group of four built by the Espen-Lucas Machine Works, Philadelphia, for the Erie Forge Company, Erie, Pa. The machine is designed especially for handling all odd-shaped forgings, crankshafts and billets, and when equipped with a 40-in. diameter saw blade has a capacity for sawing round and square bars up to 12-in. sections. The feed and speed variations are such that the machine will saw these materials at an advance of 6 in. per minute. The drive is through a main shaft, phosphor bronze worm wheel and crucible steel worm, running in oil. The spindle extends the entire width of the saw carriage, and the saw blade is bolted directly against the driving gear, thereby assuring rigidity and avoiding tortional strains between the gear and the saw blade.

The saw carriage has a feed of from ½ to 6 in. per minute, which is obtained through friction plates, controlled by a hand lever, which lock automatically, and permit change in cutting speed while the machine is in operation. The saw carriage has quick return mechanism, which is controlled by the same lever. An automatic stop for controlling the carriage is provided. Any type of saw blade, including the inserted toothed or solid high speed steel types, can be used on this machine. Either compressed air or screw clamps are furnished, depending upon the requirements of the user, for the rapid handling of stock. Where multiple cuts are to be made, the machine is equipped with a stock feed attachment of sufficient capacity to handle bars 12 in. in diameter and any length up to 20 ft.

The usual drip pan located below the saw at the front of the machine has been replaced by a reservoir in the concrete foundation, which is accessible from the rear of the machine when cleaning is necessary. The foundation takes care of the drainage.

In shop tests, as well as in practice, the machine has cut steel billets 10 in. square, .35 to 1 per cent. carbon, in 4 min. 50 sec.; steel bars of 12-in. section and the same carbon content, in 6 min.; 9-in. sections in 3 min.; 6-in. sections in 1 min. 27 sec.; round billets, 5½ in. in diameter, in 50 sec.; round billets, 3½ in. in diameter, in 27 sec.; and steel bars containing 45 per cent. carbon, 3½ per cent. nickel, 9 in. in diameter, in 3 min. 27 sec. The machine is driven by a 25-hp. General Electric motor and weighs about 30,000 lb.



The Espen-Lucas Heavy Cutting Off Saw

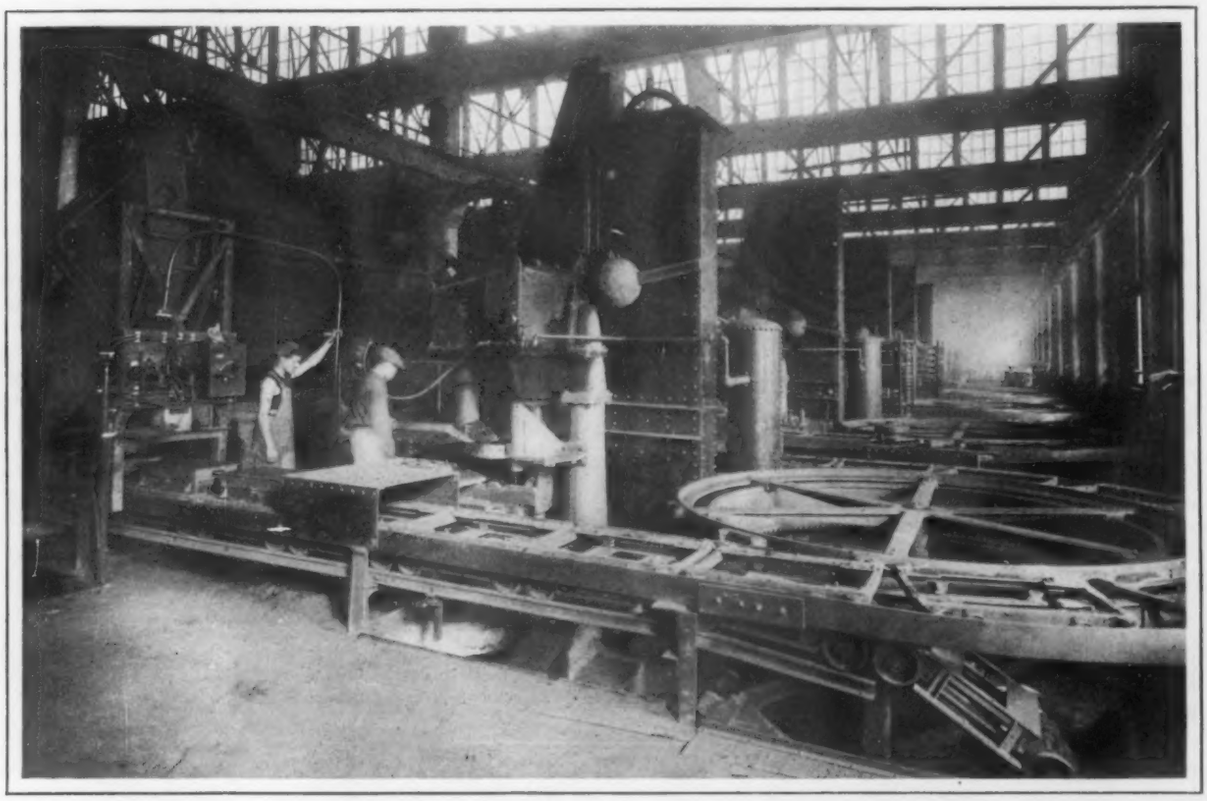
A Foundry with Continuous Molding Units

Remarkable Castings Plant of the Enterprise Mfg. Company, Cornwells, Pa.—Cupola Charging and Gas Power Plant Among Features

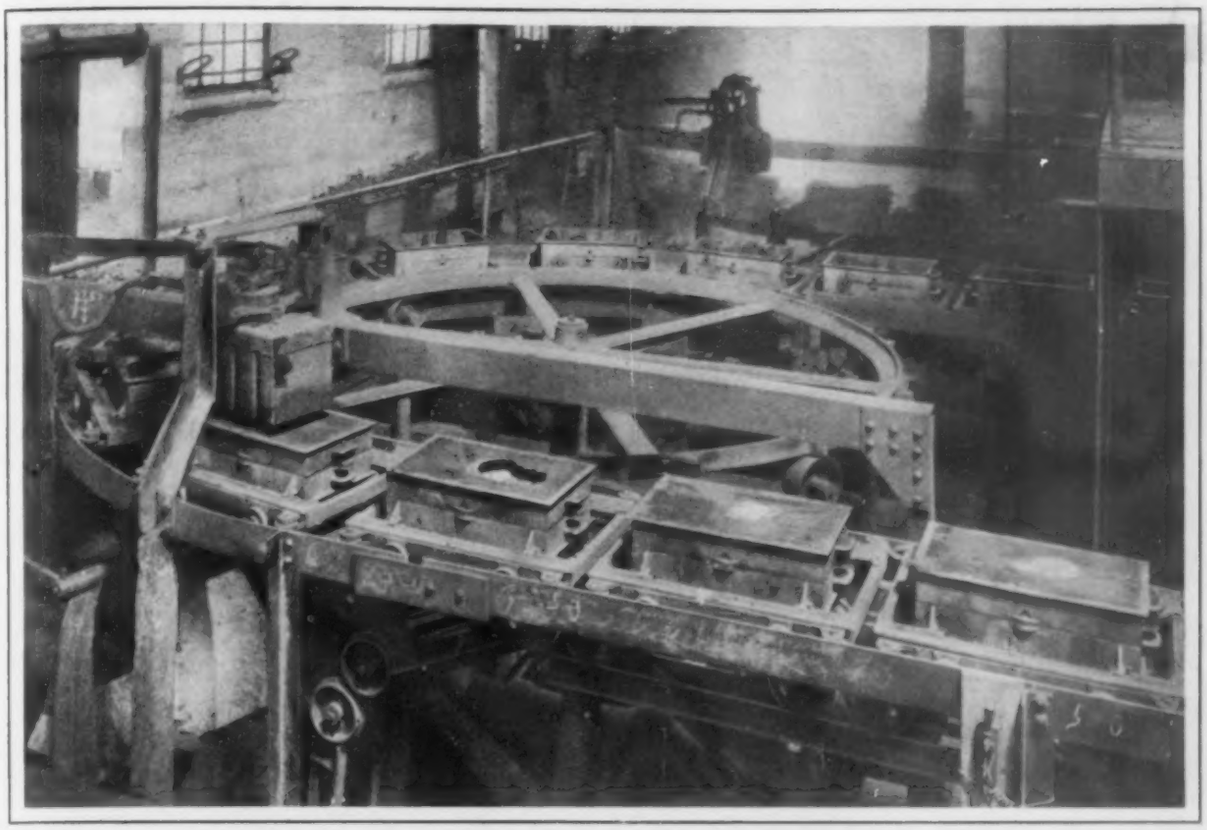
A foundry remarkable in respect to unusual machinery, which is calculated to make most of the foundry operations substantially automatic, in respect to the study made to minimize muscular effort on the part of the foundryman himself, with resultant minimum waste effort and motion, and in respect to the general arrangement of buildings and the utilization of fuel energy for power and other purposes, is that of the Enterprise Mfg. Company of Pennsylvania, located at Cornwells, Pa., about eighteen miles north of Philadelphia, on the Delaware river. The general foundry operation is what may be called the continuous method of molding and pouring, but here the continuous system is divided among a number of independent machines, comprising a molding machine proper of special design and the conveying systems in connection therewith, so that each unit, as long as may be needed, will handle at most two different molds. The castings made by a given machine therefore require a quantity of iron for each pouring which the pouring operator soon comes to know and the system differs from that in which the molds as they come to the pouring point require varying quantities of the molten iron, which may not be fully apprehended by the operative having the work in hand.

The subdivision among units also means that any one machine may be run independently of the others, and in the event of any accident happening to a part of the machinery of one unit, only a part of the entire plant is temporarily crippled. There are numerous details of the plant of considerable interest and it is intended for the present to cover some of these in a more or less general way, reserving for some later issue an account of the further experiences and developments and additional details of operation. It may be stated at the outset that *The Iron Age* is pleased to have the opportunity to explain part of the installation at this time, for while the general molding machine proper and the features of its operating makeup are patented, there are doubtless numerous foundries where the machine or a modification of it could be employed. Undoubtedly arrangements could be made with the Enterprise Mfg. Company for building machines along the same general lines or the lines covered by the patent. It is partly, therefore, on account of the unusual interest attaching to the foundry, and also to the fact that the general principles can be taken advantage of by others, by suitable arrangements with the company, that the following account is attempted.

The Enterprise Mfg. Company is a business of long standing and is a manufacturer of hardware specialties, being best known probably for its sad irons, food choppers and coffee mills with which the name Enterprise has been identified. It was established by the father of Charles W. and H. E. Asbury, now in charge of the business, and from the manufacturing side represents the type of establishment which has grown from time to time, and which, located in a well developed city, has had to expand in an upward as well as horizontal direction, resulting in buildings of two and more stories in hight. The necessity further to enlarge, coupled with the growing difficulties of the help question, led to the decision some years ago to locate outside of the city, where it would be possible to build a plant having a single story, with resultant good illumination, and where altogether modern manufacturing arrangements could be provided. The result is that the company has now in operation a part of a large plant which it has built on a site of 82 acres obtained near Cornwells, Pa., on the Delaware river, as stated. The site has the advantage of railroad sidings with the Pennsylvania Railroad and water navigation down the Delaware river in one direction, and up at least as far as Trenton in the other, both ways of communication accommodating the receipt of material for manufacture and shipment of manufactured products. Sand suitable for the foundry, for ex-



View of the Molding Machines Taken at the Point A on the Works Plan, Page 54, Showing at the Lower Right the Rising Chain of Supporting Plates for the Molds, at the Upper Left the End of the Conveyor Carrying the Weights for the Molds and in the Center Molding Machine Proper at the Side Where the Completed Molds Are Received

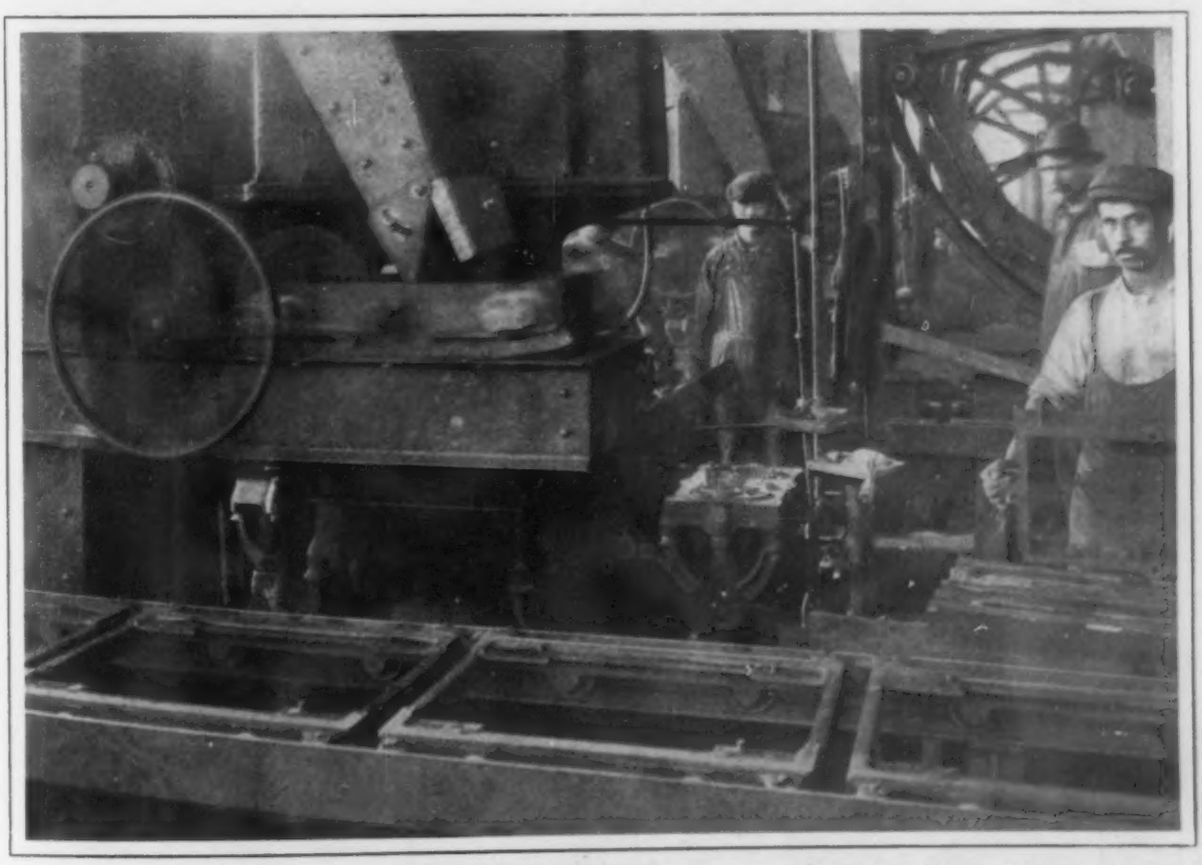


Discharging End of the Mold Conveyors Taken at Point C of the Works Map, Showing Receding End of the Mold Carriers, Resulting in Castings Beginning to Fall, and Showing Also at the Left the Ram for Forcing Out the Sand and Castings and Beyond the Returning Line of Empty Flasks

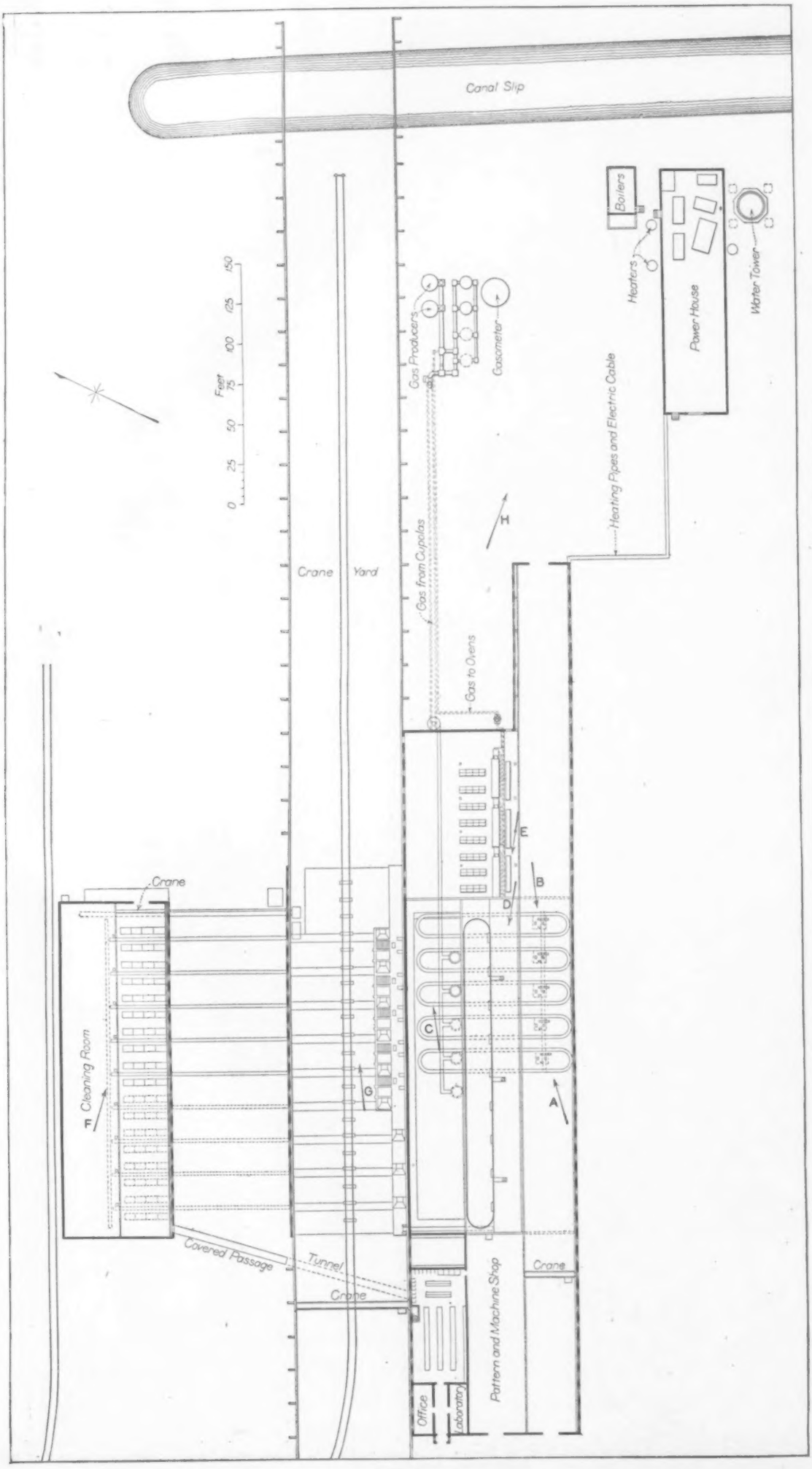
ample, is obtainable from Burlington island not far away.

The development of the site for the manufacturing buildings, which, it should be stated, are at present supplementary to the Philadelphia factory, which is still running to full capacity, made advisable the provision of a canal or slip from the river into the plant site. Water for all purposes is obtainable from artesian wells, but for power, fuel has to be brought in, and it was decided to put in a producer gas plant and operate the machinery of the foundry by electric motors, installing gas engines in a power plant for driving the electric generators.

In the meantime, experiments had been conducted on the



View of the Molding Machine, Showing the Pattern Ready to Receive the Flask, and at the Left the Mechanical Riddler in Motion, and at the Upper Right the Large Sprocket Carrying the Chain of Weights for the Molds, This View Taken at Point B



MAP OF THE PLANT AT CORNWELLS, PA., OF THE ENTERPRISE MFG. COMPANY OF PENNSYLVANIA

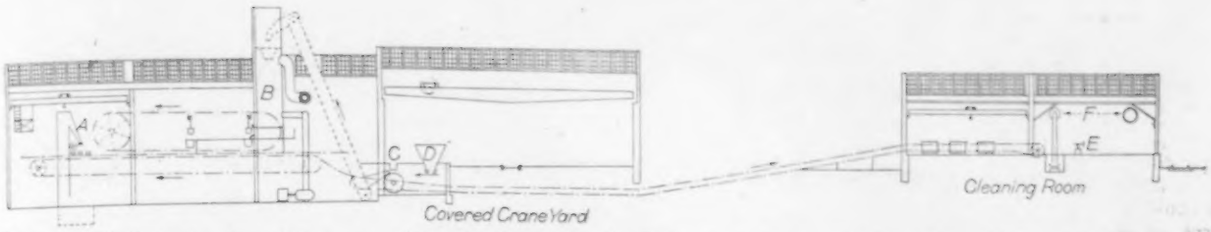
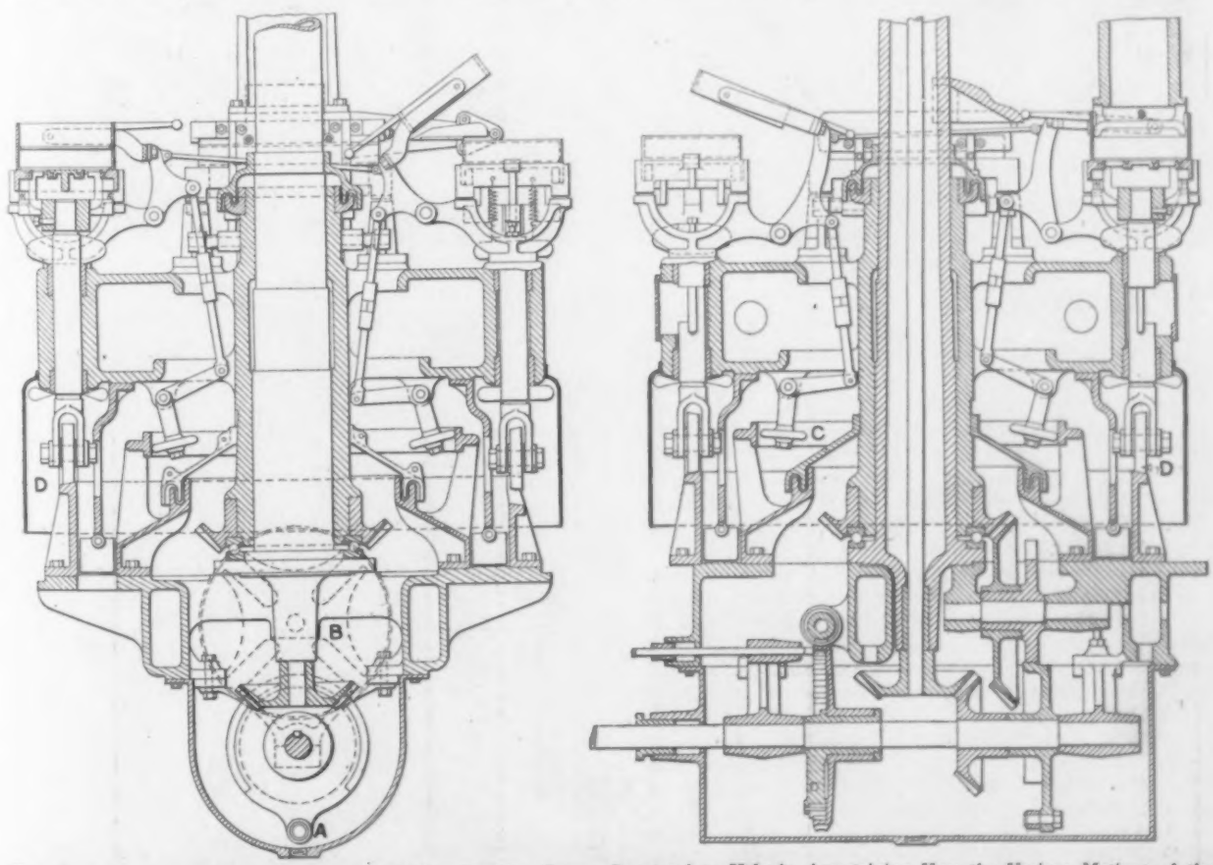


Diagram to Indicate the General Features of Each Continuous Foundry Unit. At A is the molding machine with its sand chute to the riddler; at B is the cupola with its elevating charging conveyor and its gas pipe for subsequent utilization of the calorific value of the waste gases; at C is the pig iron breaker; at D is the sand hopper for the fresh molding sand needed from time to time; at E is the small grinding wheels for finishing the castings, and at F are the supply and return air mains of the tumbler dust removal system

erection and operation of molding machinery calculated to give continuous pouring and mold and castings conveying and continuous sand tempering. The preliminary experiences with a machine at the Philadelphia plant, and later with a larger machine of the size incidentally now installed at Cornwells, were successful, and the new plant was laid out to accommodate the special machinery which has made the present foundry so interesting and so promising from the standpoint of producing at low cost.

At this writing assembled drawings of the present machine are not available, but an accompanying drawing has been made to outline some of the features of the molding machine itself, and this with the general plan of the works and also a sectional elevation in diagram form of a part of the plant, will serve to indicate the general features of the continuous molding machinery. Briefly described, each molding machine and its conveying system includes the molding machine proper; a conveyor for the molds; a conveyor which deposits on each mold at the proper point the weight to hold down the two parts of the flask during the pouring period; a ram to discharge the red hot casting at the end of the mold conveyor, which of course, carries the empty flask back to the molding machine, moving in a continuous circuit; a conveyor which slowly carries the hot casting after it has passed over a grid or screen to divest itself of loose sand, the casting proceeding to the cleaning house, where it arrives sufficiently cooled to be handled; an arrangement of tumbling barrels in close proximity to the casting conveyor, so that workmen at this point may by hand hammers detach the sprues from the castings, throwing the castings into the barrels; another conveyor upon which the sprues are dumped by the castings conveyor so that all surplus iron may be recovered; a system of conveyors for taking the sand after it has been removed from the molds and delivering it again to the molding machine after passing through sand grinding and tempering devices; and in connection with the sand treating plant, a magnetic separator which catches the shot iron and delivers it to the castings conveyor by means of which, together with the sprues, it reaches the iron recovery conveyor already mentioned. The whole system moves in unison, so that the molding is done no faster than it is possible to do the pouring, and the mold conveyor moves strictly in synchronism with the molding machine.

As the plant is laid out, it is the intention to use bottom pouring ladles, but this system has not yet been thoroughly perfected, and the molds are poured from hand ladles. Each machine as at present operated makes 150 molds an hour, but there is no evidence of intensive production on the part of the operatives, and it will probably be easily possible to accomplish a production of 200 molds per hour without exertion on the part of the operatives who have relatively light work to perform, particularly as compared with ordinary foundry operations. Two men are provided for each molding machine and one suffices to take care of the pouring. One man at the molding machine places the empty flask coming on the conveyor to him, the conveyor being within arm reach, and his operation is substantially to carry his arms through a quarter circle, placing the flask on the machine. Two-part molds are made, and first he places the drag half of the flask on the machine, which carries the pattern for that half permanently fixed to the machine. Then the machine au-



Two Sections of an Early Design of the Molding Machine Proper, Presented to Help in Ascertaining How the Various Motions of the Machine Are Accomplished

tomatically makes a quarter turn and he places the cope part of the flask in position. Again the machine makes a quarter turn and he is ready to put on the machine the drag half of the flask for a duplicate or a second pattern. With the next quarter turn of the machine he places the cope part and the cycle is performed over again. Ordinarily the machine is making molds for two different patterns, although, of course, with duplicate sets, the machine could be turning out one type of casting only, the patterns, as stated, being fastened to the machine.

On the first quarter position after the flask is placed on the machine, the drag half comes underneath a mechanical riddler, this also forming a part of the molding machine. These quarter-turn movements of the machine for a production of 150 molds per hour, mean that the operator places a half flask on the machine every 12 sec; that is 5 half-flasks a minute, or 300 for the hour. The machine making two molds per revolution, therefore makes 75 complete revolutions in an hour. The stop at each point is sufficiently long to accommodate satisfactorily the different operations of the machine. The operator has time not only for placing the flask in position, but for shaking on the parting material, and in the case of the cope section for inserting the inverted cone pattern employed for the sprue. Similarly, there is sufficient time for riddling all the sand that is necessary. For this purpose the sand which has been tempered in the devices provided on the floor below, is elevated to a point above the molders' working floor, and the sand by gravity is delivered through a chute and through the riddle, which is agitated in a mechanical manner by a motor mounted on the machine.

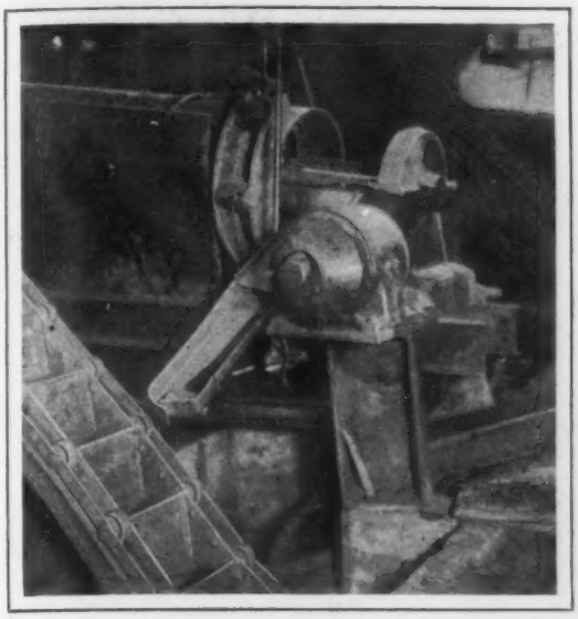
In the next position of the machine, the sand is squeezed, and for this purpose there is an air cylinder, and the air is admitted automatically as each quarter turn is made. In this connection, to accommodate the machine to different character of patterns, the piston connected with the plunger is fitted to a counterbalance lever carrying a weight. The position of this weight is varied to suit the degree of pressure which it is desired to exert in the sand squeezing operation. This is determined more or less by judgment at the outset and by actual experiment, and for each pattern there is an indication of the proper position of the weight. As the machine makes each quarter turn and the squeezed mold leaves its position to take its fourth and last position on the machine, the surplus sand is struck off by the machine itself, and when it reaches the fourth position the bottom board is placed on the drag in the case of this part of the mold, and the drag half of the mold is then placed on the traveling conveyor alongside. Just as the man feeding the machine has the conveyor within arm's reach, so the man at the finishing end of the machine has the conveyor back of him also within arm's reach.

The degree to which little things have been given attention may be mentioned in this case in connection with the bottom board to the drag half of the flask. The bottom board is fixed by loose, flexible or chain type hinges, so that when this part of the flask is placed on the machine, the bottom board hangs and is carried around with the machine until it takes the fourth position, when the operator has the bottom board ready to be swung on top and fastened by snaps or clips, which clips are advantageous when the ram, after the mold, has been poured, forces the completed casting and its sand from the flask. The operator at the fourth position when it comes to receiving the cope portion, is required to remove the metal pattern for the sprue which was placed, as stated, on the pattern by the workman at the first stage or position of the machine.

It should be added further, that the patterns are of the draw type. As the completed mold leaves the third position of the machine and is turning toward the fourth position, the draw portions of the mold are drawn downward by the machine and the operator at the fourth position finds no special care necessary in lifting the completed half portion of the mold. Then as the pattern is moving toward the first position of the cycle of operation to be used another time, the machine automatically replaces or forces upward the draw portions of the pattern which were withdrawn temporarily, as stated. The actions of the workmen become practically involuntary and the matter of molding becomes one of continuous more or less rhythmical moves.

The accompanying sectional drawings of the molding machine proper are, as stated, not exactly the design of the machine as it is at present installed, but some of its features or the general ideas behind it may be apprehended. The drawings show the machine driven from a worm and worm gear. From this the main shaft of the machine itself is driven, and in this connection is an application of a form of cam seen in some watch movements, for example. Mounted on the main shaft is a large wheel or disk carrying a pin. This pin, A, fits in the slots of the control mechanism B. For each entire revolution, therefore, of

The Pouring Floor, View Taken at Point D of the Works Plan, Showing the Overhead Rails of Both the Present and the Later Permanent Method of Conveying Ladles from the Cupolas, One of Which, Running Molten Iron, May Be Discerned at the Right



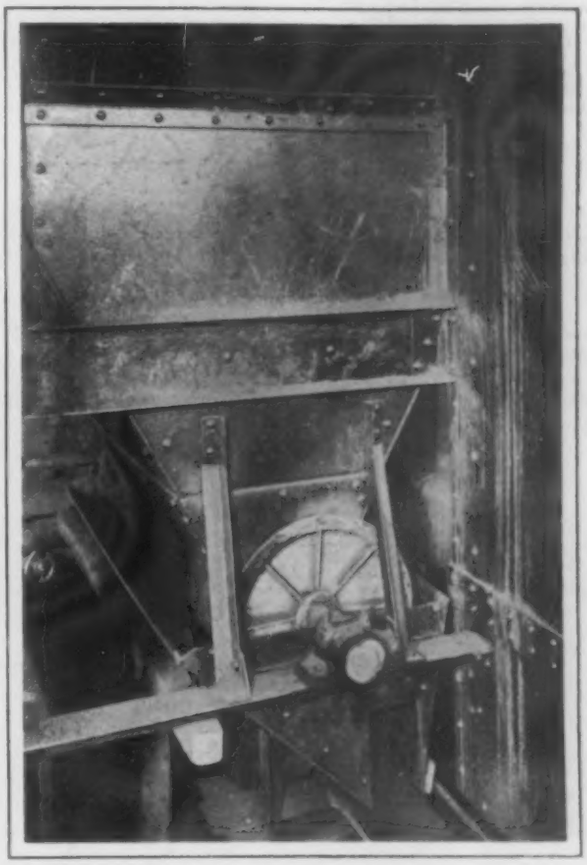
View of the First Sand Grinding Mill with Magnetic Separator Delivering the Shot Iron to the Bucket Conveyor in the Foreground

the main shaft and pin A carried around with it, the control device B takes but one-quarter revolution, and its position for each quarter is definitely and accurately determined. This is one of the features of the machine, requiring that at each quarter of a turn the parts of the entire mechanism of the molding machine and mold conveyors have definite and positive relations with one another.

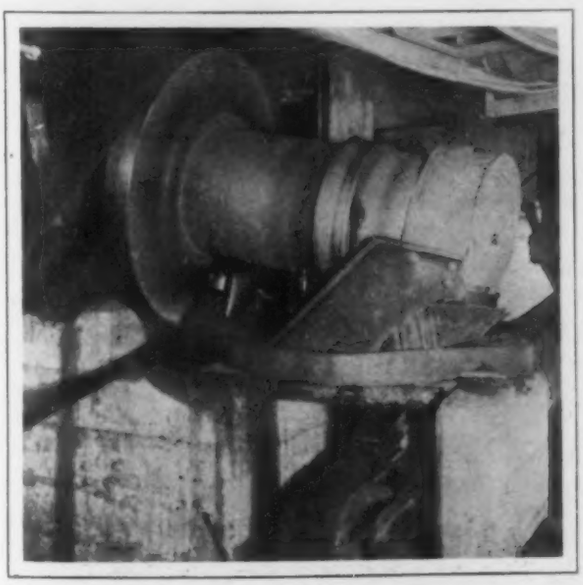
From the shaft on which B is mounted, the machine in general is actuated. The conveyor carrying the molds naturally moves forward a proper distance at every half revolution of the molding machine, as it must first receive the drag half of the mold and then the cope half, before it should move to the next position.

At C in the drawings is indicated a kind of roller wheel follower which rides against a cam rail given the proper contour so that the levers connected to the roller are moved to raise and lower the sand guards prior to carrying each part of the flask to the squeezer portion of the machine. These guards are shown in the raised and lowered positions. At D is marked another form of cam, so to speak, or track with a variation in level, so that the draw of the pattern can be accomplished in the manner mentioned. This brief description will serve to indicate some of the features of the operation of the machine, together with the accompanying reproduction of photographs.

The pouring floor is at a higher level than the molding floor, so that the tops of the molds may come at a convenient point for casting. The photographs show the main chain of the mold conveyors; a separate conveyor brings up the plates on which the mold itself is supported, and immediately thereafter, from an overhead conveyor, are deposited the heavy iron weights for holding down the two parts of the mold. These weights are rectangular pieces of iron with holes located to come immediately over the gate of the mold. The castings then continue on the conveyor to a point calculated to give the castings time to solidify to a proper extent. Here a ram, when the conveyor comes temporarily to rest, forces the sand and its castings, as already stated, to a chute below. The chute has a gridiron construction through which the sand and small iron particles may fall, leaving the casting to proceed further, where it is discharged to a trough type metal conveyor. Previous to the castings arriving at this dumping or shaking out point, the weights have been lifted off by the separate conveyor for this purpose to be carried overhead backward to the point of start, as similarly the carrying plates, which had come up to the conveying system at the starting point, have receded and are proceeding forward in the basement of the building to the point of start.



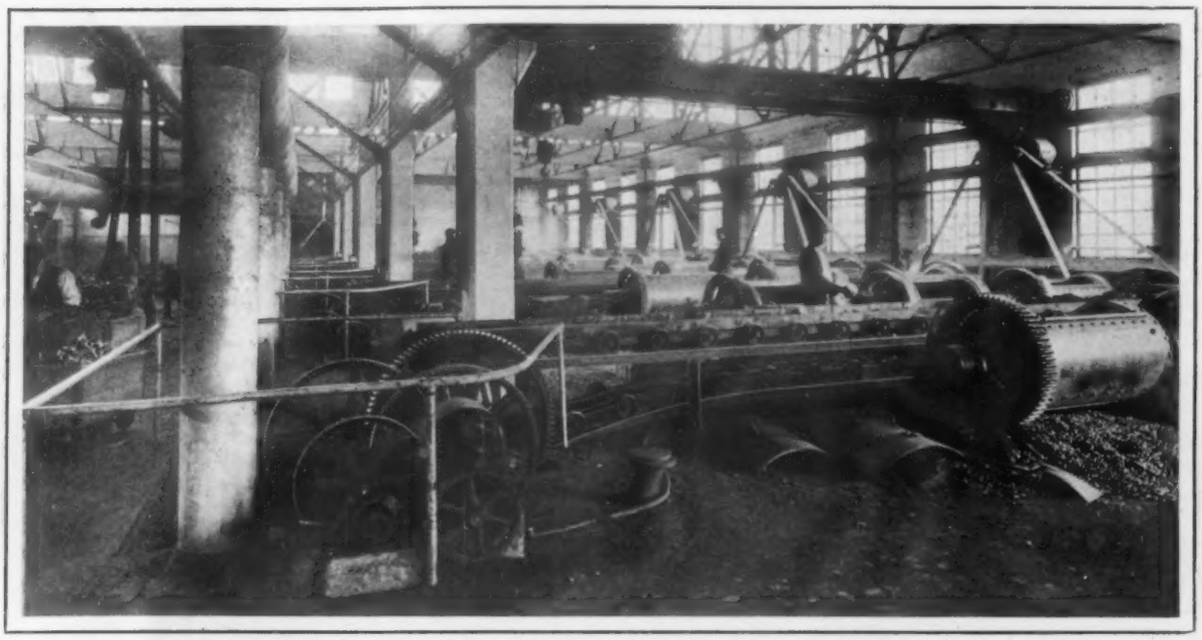
The Sand Rolls at the Base of the Molding Machine Proper, Showing at the Right the Inclosure of the Sand Elevating Conveyor



View of Another Part of the Sand Treating Equipment, Showing at the Bottom the Belt Conveyor to Which the Sand is Delivered

The sand passing through the openings in the casting chute is immediately taken by a sand mill of the inclined revolving, cylindrical sort. At the discharging end of this sand mill is a magnetic separator which catches the shot iron and delivers it in a branch chute leading to the trough conveyor carrying the completed castings.

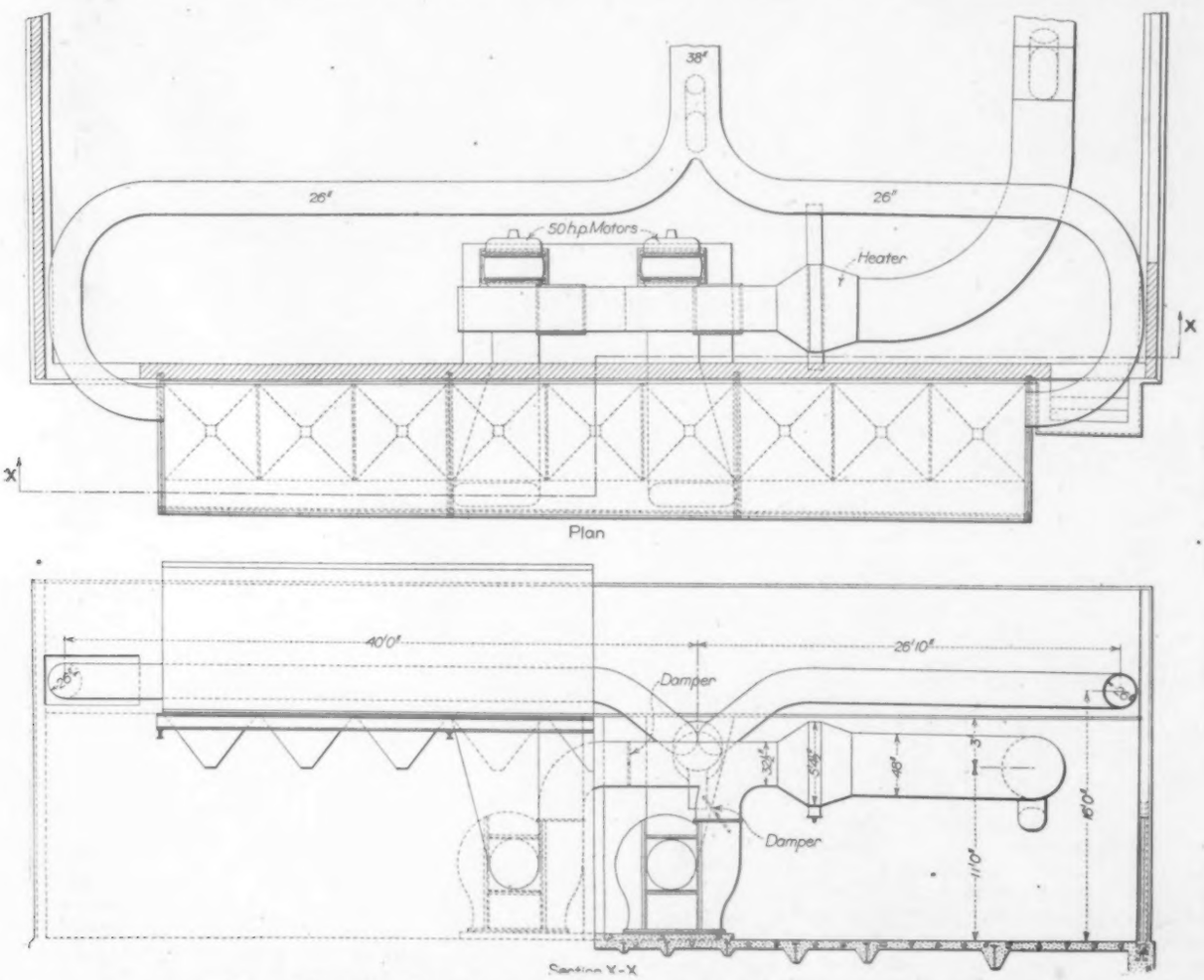
The sand is then delivered on belt conveyors and carried to further sand grinding apparatus, where it is wet and generally tempered for further use. In connection with the sand treating devices there is also a belt conveyor system from which the makeup of new sand is obtained as desired, according to the opinion of the expert having this work in hand. For this purpose there is a large sand hopper, into which new sand of proper mixture is put, and at the bottom of this hopper is a conveyor feeder delivering continuously if desired to a belt conveyor the proper amount of sand which should be added to the sand already in the cycle of operation. Finally the sand reaches a pit below the molding machine, where it receives its final



View in Cleaning Room Taken at the Point F of the Works Plan, Showing the Rows of Tumbling Barrels Driven in Groups by the Motors on the Wall, with the Casting Conveyors Alongside, and the Dust Pipes at the Left

treatment in special rolls and from which it is elevated to the hopper and chute above the mechanical riddler. There is one sand-supplying hopper for each machine, and they are all located in a covered storage yard.

In the meantime the casting has been proceeding slowly along the trough conveyor. This conveyor was made as long as possible and the speed of translation made as slow as possible, so that at the end of this conveyor the casting would be cool enough for handling with heavy gloves. The accompanying cross-section diagram may here be referred to. This shows at A the molding machine proper, with the sand chute to the riddle and the positions of the mold. It also shows the overhead circuit of the conveyor carrying the weights for the molds and the longer basement system carrying the supports for the molds. In a horizontal plane, thus appearing as a line, is the continuous chain or driving portion of the conveyor proper. The diagram does not show the sand-conveying apparatus, but does indicate the overhead monorails for carrying the ladles from the cupolas to the stationary bottom pouring



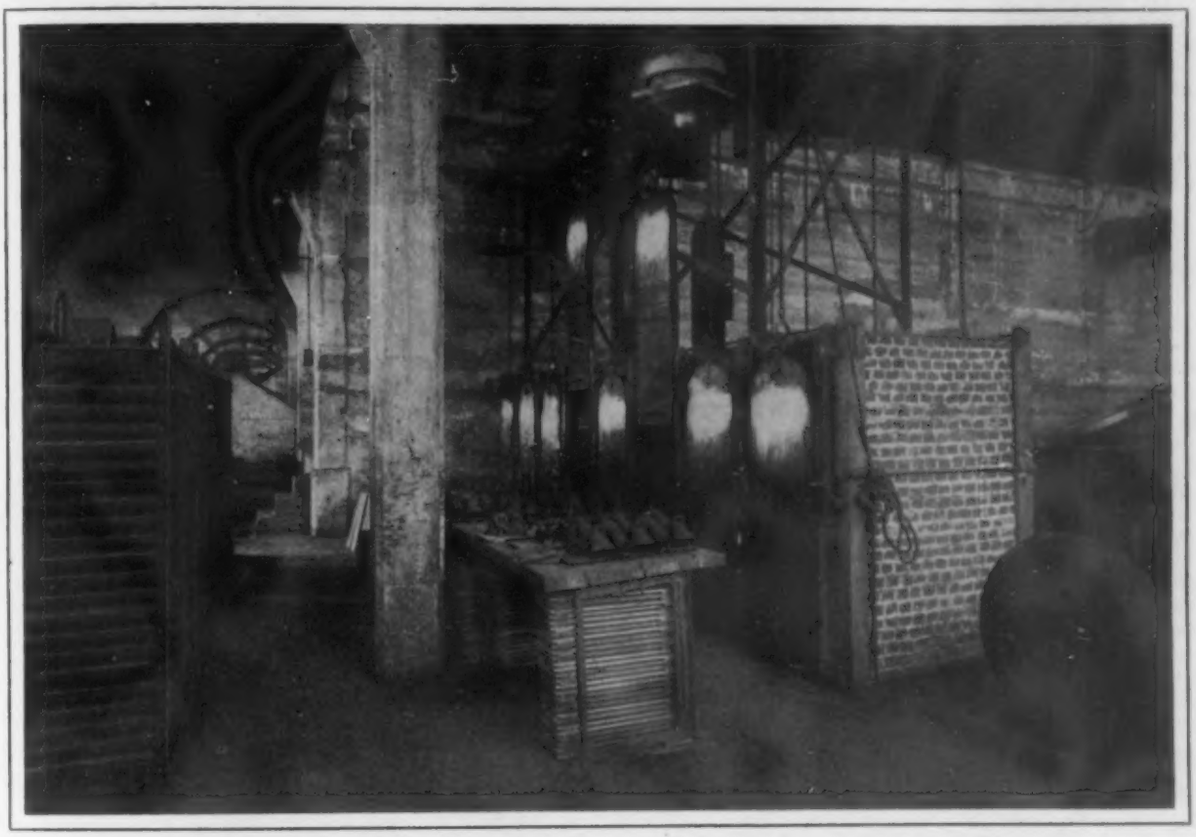
Plan and Elevation of the Main Portion of the Dust Removal System in the Cleaning Room

ladle. The latter has not yet been used, and on a separate set of Coburn overhead rails small hand ladles are carried, dumping the contents into larger ladles suspended one over the mold conveyor of each machine of the plant.

At B is indicated the cupola, which is especially interesting, not alone because a sweep type of conveyor has been provided for charging the cupola, which accordingly has a bell form of top, but because arrangements are under way for taking the gases from the cupola and carrying them in a pipe line to the gasometer of the producer gas plant for use in the gas engines of the power plant. In short, the plant comprehends a utilization of the gas of the cupola for power purposes.

At C is a pig iron breaker, the pigs being placed in holes on the platform shown and the breaker delivering the broken pigs into the conveyor by which the iron is lifted to the cupola top. In a similar way the coke may be carried to the cupola.

At B is the sand hopper in which the mix for the molding machine sand is made and from the bottom of which is taken the makeup supply for the machine, as



View in Core Room Taken at Point E of the Works Plan, Showing the Benches at the Right; the Core Ovens; the Baked Cores Waiting to Be Placed on the Wood Shelving Piled Below, and the Core Carriers at the Left into Which Are Slid the Shelving Loaded with Cores

described. Both the pig breaker and the sand hopper are located in a covered yard which is traversed by a 3-ton high-speed Niles electric travelling crane of 72 ft. span and also by one of the sidings from the Pennsylvania railroad. For the company's own use it has a locomotive mounted on the track, and the trolley of the electric crane is provided with a grab form of scoop by means of which sand may be collected and dumped into the hoppers. The arrangement of the covered craneway, which comprises 240 ft. of the 900 ft. total runway, provides for keeping coke, sand and other material from the weather.

The map of the works with its scale in feet will give some idea of the general size of the molding machine equipment, and the five machines now installed, with space for four more, are indicated. The cycle of operation is such that flasks are returned for refilling at the rate of once every 20 minutes, or, in other words, the flasks make the circuit every 20 minutes. A noticeable feature is that the pattern provided on each track is arranged to make a maximum amount of product per area of the flask, so, for example, if sadirons are being cast and they do not well fill the molds, other castings are made by incorporating the corresponding patterns with the pattern for the sad irons even if nothing further can be cast than stars for use in the tumbling barrels. Where the castings require cores, the cores are mounted on what corresponds to a match plate, and when the drag half of the mold is placed on the conveyer, an operative places thereon the plate which has the covers all located in position, the patterns being designed to allow this arrangement. Then without loss of time so far as the machine is concerned, immediately the cores are in place on the drag half, the conveyor is ready for the cope half of the mold and the operation proceeds.

The cores are generally of small character, as the castings manufactured are of small sizes. It is, of course, a feature of the plant that the work is turned out in large quantities, and in this connection the company takes contracts to make castings in quantity for other manufacturers. The cores are at the present time largely handmade on benches and these benches are located alongside of ovens which burn producer gas in connection with a blower supplied by the American Blower Company, located at one end of the ovens. At present, there are eight ovens, each 2 ft. 3 in. by 3 ft. 10 in. in inside dimensions, and about 6 ft. high, and they are provided with horizontal steel ledges, one 2½ in. above the other, projecting into the interior of the oven and forming supports on which the perforated metal plates holding the green cores can be easily slid into position at levels accommodating the hight of the cores. When baked the cores are taken from the metal plates and placed on boards and grouped thereon according to the molds into which they are to be placed, so that each board contains in succession the cores as they will be needed. These boards are loaded into portable core carriers made up of angle-iron frame-work and standing several feet high from the floor. They are fitted with a large loop at the top, into which the hook of the traveling crane can be engaged and the entire core carrier be transported opposite the molding machinery.

The cupolas were built according to the company's own specifications, and are 48 in. in diameter, with a capacity of 15,000 lb. per hour. They are not fitted with the upper row of tuyeres. As the plant is operated at the present time, there are two cupolas installed and they operate on alternate days, each for 8 hours. The workmen, to accommodate the continuous operation, take rela-

View Taken at Point H on Works Plan, Showing from Right to Left the Power House with the Heaters Located Against the Building Wall, the Boiler House, the Gasometer, Scrubbers and Gas Producers

tively short luncheon periods, and in successive groups, so that production is not checked. This makes the working day 8 hours from the time of start till the time of closing.

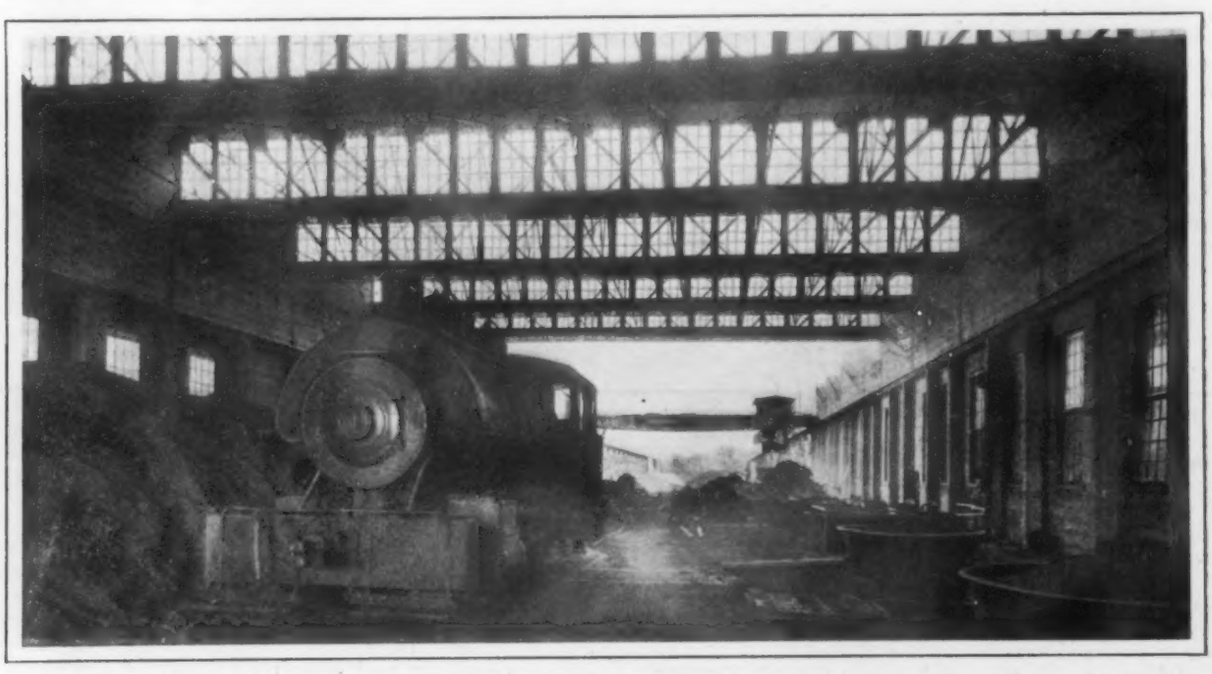
Should the molding machinery cease operation for a sufficiently long time, or for any other reason the iron in the ladles would have to be disposed of, the surplus iron is taken to the end of the pouring floor and turned into a pig casting machine. This is along the lines of the pig casting machine in the plant of a blast furnace, and the conveyor to which the pig molds are attached dumps the pig iron in the crane yard, where the pigs may be collected as needed, put into the pig breaker and delivered to the cupola sweep charging elevator.

In tunnels underneath the crane runway are carried the conveyors for the freshly made castings. Beyond this craneway the conveyors rise as indicated in the diagram on page 55, more or less in the open air, where further cooling can be obtained and finally the castings are delivered into the cleaning room. At each side of the conveyor, within arm's reach of it, is a line of three and space for a fourth tumbler. With a man stationed on one side of each conveyer in the cleaning room, the tumbling barrels may be filled on one side, while those on the other side of the conveyor, for example, are at work revolving. The diagram shows the discharge conveyor at the end of the castings conveyor, from which the iron is returned for screening and for ultimate charging into the cupola for remelting.

This diagram also shows the location of grinding wheels to which the castings after tumbling are brought for such finishing as they may need, and between the line of grinding machines occupying this part of the building and the side wall is space for sorting the castings in piles or in wheel carts ready for shipment into cars which may be lying on the track alongside. The openings at the track level are provided with rolling corrugated metal shutters or doors.

The feature of the cleaning room is the location of the tumbling barrels with respect to the incoming supply of castings and the satisfactory arrangement for dust elimination. An accompanying photograph of the interior of the cleaning room will give some idea of the parallel arrangement of the tumbling barrels which are of the Sly make, 28 x 48 in. in size, and the incoming trough conveyor containing the cooled castings. An accompanying drawing has also been presented to give an idea of the dust removal system. From each of the tumbling barrels a 5-in. branch air pipe leads into a main air pipe extending underneath the row of tumbling barrels to a point over the conveyor which receives the sprues and shot iron. Here the air pipe rises 14 in. in diameter to the upper part of the room to an air main for all the tumblers. A drawing shows the end of this main 38 in. in diameter and its leads to a dust catching bin. The air movement is set up by two blowers which take the air from the dust collecting chamber and drive through a tempering coil for use in the winter time. The cleaning room is provided with a Pawling & Harnischfeger crane.

The power production as stated comprehends a gas producer plant. At present there are in use two producers built by R. D. Wood & Co., Philadelphia, and supported in an elevated position in proximity to the crane yard in a structure of reinforced concrete members. Alongside of the producers are the scrubbers and the gasometer from which underground piping leads to the power plant in one case and to the core ovens in the other. The plan of the works shows how it is intended to utilize gas from the



View in the Covered Yard Taken at Point G of the Works Plan, Showing the Saw-Tooth Roof and the Sand Hoppers at the Right

cupolas, but at this writing the work has not progressed far enough to connect all the piping. In connection with the gas power plant, an interesting equipment has been provided for utilizing the wastes of the gas engine, including both the jacket water and the exhaust gases. In short the jacket water, after performing its service at the gas engines, is passed through a heater to which is conveyed the exhaust gases from the engines, and it is pumped around the plant for heating purposes in the winter time. The distribution of the hot water is on what may be called forced hot water system.

In the power house there are three large gas engine units, two directly connected to direct-current generators and the third to an air compressor. There is a smaller gas engine belted to a generator for use during nights and at times when it is desired to get the gas producers under operation, the producers being of the suction type. The large gas engines were all built by the Rathbun-Jones Engineering Company, Toledo, Ohio, and are of the three-cylinder vertical single-acting type. The electric units are 20 x 21 in. in cylinder dimensions and the engine driving the air compressor 17 x 17½ in. Each of the generators, which are driven at 240 r.p.m., is of 175 kw. capacity at 230 volts, and there is a three-wire distribution about the plant. The compressor is a two-stage twin type, belt driven, and the air cylinders are 14¼ and 24¼ in. in diameter and of 21 in. stroke, built by the Ingersoll-Rand Company. The map indicates in the power house plan how the compressor is installed at an angle with the general axis of the building, rather than parallel therewith. It was found that by so doing, a 4-ft. saving in the width of the building was effected without crowding the machinery. An 8-ton hand-power crane, built by the Reading Crane & Hoist Works, travels the entire length of the power house, which, it may be noted, will provide for about three times the present equipment, thus being built for decided future extension. The air is normally compressed at 80 lb. per square inch and, as stated, is used chiefly for the operation of the molding machines both in the squeezing operation and in the shaking out of the molds.

The gas engines are normally started with compressed air and for this purpose there are six cylindrical air tanks installed at one end overhead in the power house and for maintaining the air pressure in these tanks, there are two compressors, one driven by gas and the other by electricity, so that there should be no interference with continuous operation on this account. The auxiliary gas engine electric unit for starting up the producer and for electric lighting and other power work at night is driven by a 25-hp. Otto gas engine. For ignition of the gas engines a storage battery is provided and the units are charged every day, so that there is always an available supply of electricity in storage for this purpose.

On the day the plant was visited the temperature was taken of water in circulation as giving some idea of the degree of heat utilization accomplished by the heaters installed shown in the general plant immediately outside of the power house and in one of the photographs. During the morning of the day in question the temperature rose from about 20 deg. to 30 deg. in four hours and at noon, with the outside temperature at the latter figure, the water coming from the jacket of the engine had a temperature of 162 deg. F., and then after passing through the heater it was at 176 deg. and finally on returning from the heating system in the shops was brought to the jackets for use over again at 146 deg.

One heater is provided for each engine. It is of the vertical tubular sort with tubes through which the gas passes and a water space surrounding the tubes. It is 50 in. in diameter with a 2-in. packing of asbestos on the outside and contains 64 tubes 8 ft. high and 4 in. in diameter, contributing 400 sq. ft. of heating surface. The plant suffices for all days of the winter except specially severe periods when the temperature of the jacket water after passing through the heater is supplemented by passing it through one or both of two horizontal tubular boilers installed in an adjoining boiler house. These boilers, which burn buckwheat coal, are also used at night time in the cold weather so that the water is kept in circulation and not allowed to freeze as might otherwise be the case, besides having the buildings at a comfortable temperature when the operatives appear on the following morning. For the water pumping these is a duplicate installation of Lawrence centrifugal pumps direct driven by 5-hp. General Electric motors. The water-heating boilers were built by the Coatesville Boiler Works. In connection with the artesian water supply plant, there is a 40,000-gal. elevated tank at one corner of the power house, as shown in the general map, and this is under the supervision of the engineer of the power plant, who has a telltale float rising and falling within the power house, so that he knows at all times the condition of the water level in the tank.

The plant comprises an imposing array of buildings of concrete and reinforced concrete construction conspicuous for their lofty interior and their good illumination through the use of the sawtooth form of roof which covers even the power house. The buildings and most of the machinery were built and installed by the company, which bought the materials and employed its own labor. This, of course, is not true of the electric cranes and the power apparatus, plumbing and other equipment. The plant or particularly the general scheme of the molding arrangement is a development of the ideas of H. E. Asbury, but the details, which incidentally are exceedingly numerous, were developed by Mr. Brown, chief engineer of the company. The accompanying map of the work shows the relative arrangement of the buildings and also gives some idea of the provisions for extension.

The molding machines and continuous foundry units are located in the main structure of the works, at one end of which arrangement is made to install a pattern shop and machine shop to maintain repairs of the machinery, and at the other end is the core room. At the machine shop and pattern shop end of the building is also located the toilet room for the operatives and in front of this the works office together with a chemical laboratory. Here there is a corridor through which all the employees are expected to pass on their way to and from work. In the corridor are located the time clocks. Immediately beyond, in the toilet room, are clothes lockers which are of the expanded metal type. In one direction the employees can reach the machine room and contiguous departments and by an underground tunnel they may reach the cleaning room. The underground tunnel provides that none of the workmen is required to pass within the property of the company over the railroad siding.

The arrangements for the toilet room are unusually elaborate. Besides the lockers there is a double row of individual wash basins, which are Mott solid porcelain type made in double units, two basins back to back. These are provided with both hot and cold water and nickel-plated fixtures are installed in that connection. The water-closets are of the seat operation type. A series of six shower baths are also provided with slate partitions and it is intended shortly to install some arrangement by means of which clothes of the operatives may be dried in summer time when such an arrangement becomes somewhat desirable. The urinals are of the cylindrical porcelain type, extending upward from the floor and of the kind commonly installed in public stations. Metal benches are also provided in this room for the convenience of the workmen.

Micrometer for Getting Hub Thickness

The micrometer shown in the illustration is designed by the L. S. Starrett Company, Athol, Mass., for measuring the thickness of hubs in wheels and gears where extreme accuracy is desired. The frame, instead of flaring out in a semi-circular form, is offset but slightly from the center line of the spindle, thus making a tool so slender that it may be inserted in holes as small as ¾ in. diameter. It has the company's speeded thumb piece and ratchet stop, and also the lock nut for use in gauge work. The tool constitutes a striking advance in method because it insures absolutely correct measurement. The old way was to lay a straight edge on one side of the hub and run a steel rule through the bore, reading the thickness on the side opposite from the straight edge. Only when the diameter of the wheel or gear was small could calipers be slipped over and the thickness of the hub thus measured.

Starrett Micrometer for Measuring Hub Thicknesses

A Cheap, Efficient Cost System

Workman Is Trusted to Keep His Own Time in Getting at Production Expense

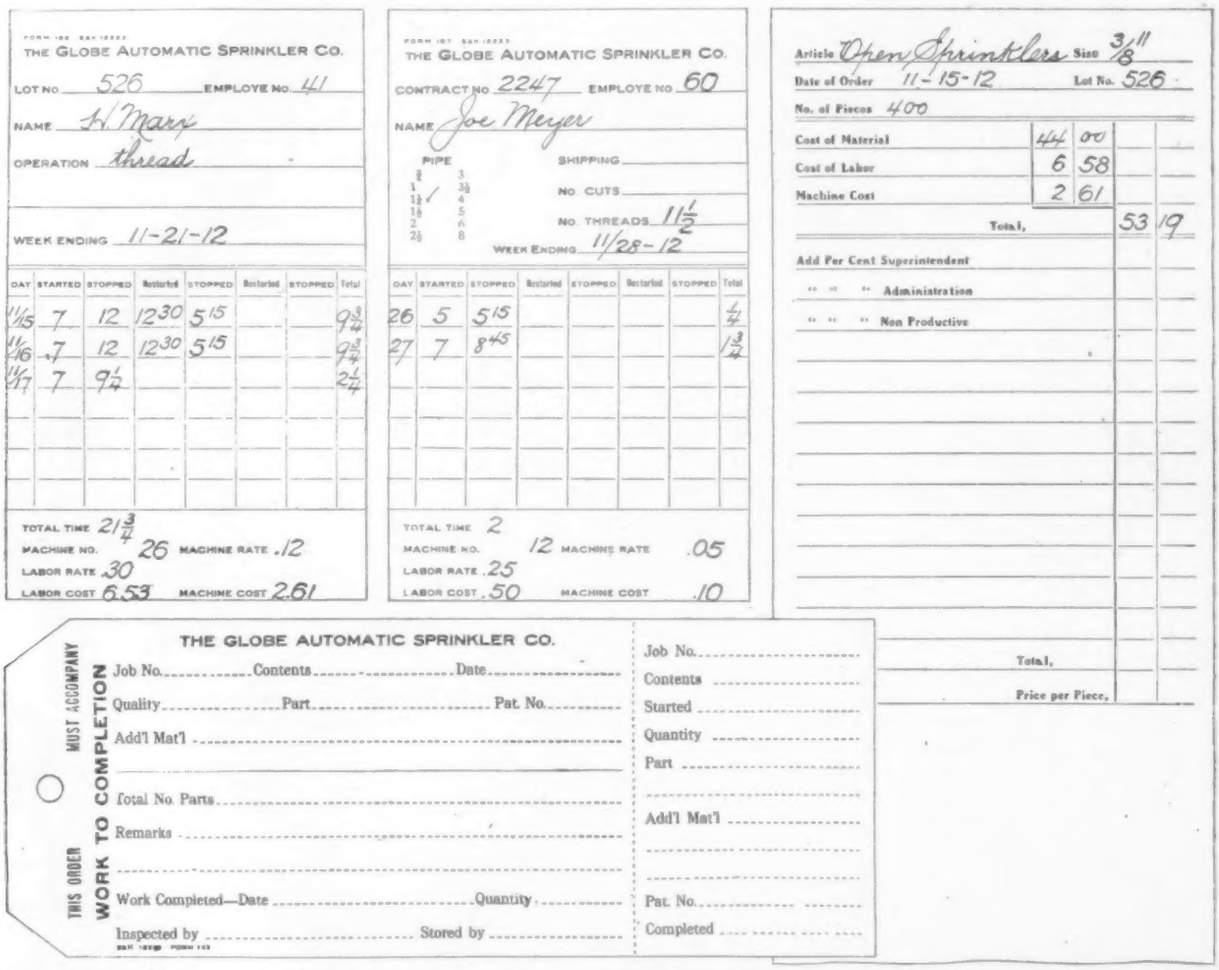
The Globe Automatic Sprinkler Company, Cincinnati, Ohio, has established in its new factory an efficient but simple system for keeping the productive labor cost of each job as it passes through the various manufacturing operations, and for assembling its total with those of material and overhead. A distinctive feature of the system is that each workman maintains his own time card. These are not employed in making up the payroll; the time clock records are depended upon for this purpose, the cards being used in this connection as a check only. The maintenance of the system is thus confined to the office, excepting that each workman acts as his own clerk. The men like the method, the chief reason being that they are relieved of much of their prejudice against "punching the clock" and have no time clerk constantly in evidence. It has been found also that the system encourages competition as to records of production. The time required of the mechanic in filling out his card is so small an item as to be negligible.

When a lot of any one element of a sprinkler system is required of the shop for a special contract or for the stock room, an order is sent to the foreman of the department which is to do the work and he distributes the time cards among his men, giving each a list of what is wanted of him in the way of labor. Each type of machine has its distinctive ticket color. A card of the sprinkler head department is reproduced in Fig. 1 and that of the pipe department in Fig. 2, the latter having spaces for more detailed instructions, including blanks to indicate the size of pipe and the number of threads and cuts. A similar card is used in keeping track of non-productive labor.

The productive labor card contains the lot number, the name and clock number of the workman and the operation, together with a space in which is indicated the week which the card covers. At the bottom are spaces for the total time and the labor rate per hour and the machine number and its rate per hour, the latter factor being determined by exhaustive tests and includes all elements of overhead. Thus the final total of labor and machine expense are easily determined, constituting the total cost exclusive of material. All entries on the card, excepting the workman's time, are made in the office.

As the time cards are received by the cost department they are filed by lot number in envelopes, one of which is shown in Fig. 3. With the time cards are placed a copy of the stock cost card, and therefore the cards combine to give the exact total cost of the lot, either to date or as a completed item of production to be entered on the back of the envelope.

With the wide range of pipes and the multiplicity of fittings which enters into every sprinkler system, it is necessary that each lot of material shall go forward as a unit from the time it is delivered to the foreman in the form of raw material, until it arrives at the shipping room. To facilitate this, preventing the mixing of materials, each lot has its tag, Fig. 4, which must accompany it at all times. The stub of the tag also goes to the cost envelope of the lot. Upon the return of the tag with the completed lot, its record is transferred to the stub, to make the history of the product complete. An imperative duty of each department is to see that the tag proper remains with the lot.



The Time Card System of the Globe Automatic Sprinkler Company. The Time Cards, the Envelope in Which the Cost Record of Each Job is Assembled and the Tag Which Follows Through the Works in the Process of Manufacturing

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Fred C. Gardner, receiver for the Atlas Engine Works, Indianapolis, Ind., has been ordered by the court to distribute $84,000, accumulated while he was operating the plant. The merchandise creditors will be paid in full, receiving $63,459.89, and the attorneys and receiver will get $20,551. The preferred and common stockholders get nothing. The holders of the bonds, aggregating $1,050,000, have the real estate as security for their claims.

Making an Accurate Delivery Promise*

How to Ascertain the Time to Manufacture an Article Involving Foundry and Machine Shop Operations

BY STUART DEAN

The superintendent can give an accurate delivery promise by making a time schedule of that casting on a given job which takes the longest time to get through the plant. Other parts of the job need not be considered, if it is assumed that they will arrive at the assembling floor before this controlling casting gets there, and steps are taken to insure that they will. The time required by this casting is the shortest possible time in which the complete job can be turned out.

In busy times the superintendent should add to this time an amount representing the time that the casting under consideration has to wait to get into the various machines. To do this he must know how far behind the plant is in its work. If the total possible tonnage output of the plant per month is known and compared with the total tonnage of the orders on hand to be filled, the number of months, or the fraction of a month that the plant is behind is shown. This time, added to the shortest schedule time, will give the total time any given order will require in the shop.

The material routing clerk sees that all the other parts are routed through the shop so that they arrive at the erecting floor ahead of the controlling piece. At the time the controlling piece arrives on the erecting floor an erecting order is written by the routing clerk. He passes the bill of material to the finished stores department, which checks all the material to see that no part is missing. If a part is missing the material routing clerk is notified and he sees that the part is rushed to the erecting department so as not to delay the erecting.

Determining the Accumulation of Work in Departments

It is a good plan to mark the weight on each order. File the order sheet under the name of the department in the plant in which the commanding casting is. Thus one portion of the order sheets will be under the office, drafting room and pattern shop division of the file, another portion will be under the foundry, another under the machine shop and still another under the erecting division of the order file. It is well to divide the machine shop portion of the file into two divisions, one representing the first machines that the commanding casting goes into, and the other representing the later machines.

Once a week the weights of all the orders in each division of the file are added up and a table is made giving the weight of orders in each department. Then by dividing the pounds of orders in each department by the average daily tonnage capacity of the plant, the number of days' work ahead in each department is shown. This indicates whether or not more men should be put in to work any department. Keep the correct number of men in each department. If a plant has more men than work, the output per man will drop and the cost rise. If the work accumulates, the customer will suffer.

When the plant gets far behind in its orders it is a good idea at intervals—say once in two weeks—to make a list of all orders on hand, arranging them in the order of their shipping dates. Place the most urgent order at the top of the list, the next second, etc. Give copies of this list to each of the foremen and straw bosses.

Such a system will insure shipments being made on the promised date, assuming, of course, that judgment is used in making up these dates. Of course, this list will be continually rearranged. Some orders will be inserted ahead of others. Where a special case comes up, even a new order may be inserted near the head of the list.

Figuring the Time of Completing An Article

The system may be made clearer by an example. Suppose, by observing the weights of pumps shipped during a stretch of time when the plant is pushed to the limit, the output is found to be 10,000 lb. per day. The weight of each pump ordered is placed on the order sheet. If the weight is unknown its estimated weight is placed on the sheet. These order sheets for pumps still to be built are filed, as said elsewhere, in a file which is divided into the following department sections: (1) office, drafting room and pattern shop; (2) foundry; (3) boring lathes; (4) other machines than boring lathes; (5) erecting.

On the first and fifteenth of each month the weights on these order sheets are added up for each department. Suppose these weights are as follows: 48,000 lb. of pumps held up by office, drafting room and pattern shop; 25,000 lb. of pumps in the foundry; 100,000 lb. of pumps waiting to have the cylinders bored; 160,000 lb. of pumps the cylinders of which have been bored, but all of the controlling parts of which are not as yet on the erecting floor; 160,000 lb. of pumps in the erecting department. With an output capacity of 10,000 lb. per day, the plant then has 4 4/5 days' work held up by office, drafting room and pattern shop, 2½ days' work in the foundry, 10 days' boring, 16 days' work in other machines than boring lathes and 16 days' work for the erecting floor. From these figures it is a simple matter to tell how long a pump will be delayed in the plant by the orders that are ahead of it, if it takes its turn.

Providing a Date Schedule for Rush Orders

The time it will take to rush a single order through the plant ahead of everything, regardless of the other orders, is ascertained as follows: Each pump has some one part on it that takes longer to get through the plant than any of the other parts. This is the part that controls the shipping date. We will suppose it to be a pump cylinder. A schedule is made out on this part thus:

January 2—Cores made.
January 3—Casting poured.
January 4—Casting cleaned.
January 5—Sunday.
January 6—Bore.
January 7—Mill
January 8—Drill and tap for seats.
January 9—Clean and seat.
January 10—Erect.
January 11—Erect and test.
January 12—Sunday.
January 13—Ship.

A copy of this schedule is given to each of the foremen and one to the material routing clerk. This estimate of the time allowance for each step in the work in the schedule is obtained from each of the foremen, so that the schedule is the foreman's own estimate of the time it takes to get the controlling piece through his department.

*Copyright, 1913, by Stuart Dean. Eleventh article on Shop and Foundry Management. The preceding articles and their dates are as follows:

Economies in Foundry Mixing and Melting, September 19, 1912.
Ways of Losing and Saving Castings, September 26, 1912.
Economies in Mold Making in the Foundry, October 10, 1912.
Arranging Patterns for Molding Machines, October 17, 1912.
Making a Success of the Machine Shop, November 7, 1912.
Designing Patterns to Save in Machine Work, November 14, 1912.
The Duties of the Factory Superintendent, November 21, 1912.
Selecting, Sorting, Treating and Paying Men, November 28, 1912.
Adopting Piece Work and Premium Systems, December 5, 1912.
Production System for a 200-Employee Plant, December 19, 1912.

This being so, the foreman sees to it that the piece goes through on time.

The Use Made of Kicks from Customers

Whenever a customer makes a complaint about a flaw or bad workmanship, give a copy of the letter to each of the foremen, testers, inspectors, etc., that are implicated. It will have a stimulating effect, and will put these men right in the game. An improved product and a reduction in the number of kicks will result.

Mechanical Properties of Ternary Steels

Charts Covering Tensile Strength, Ductility, Hardness, Etc., of Various Alloy Steels

BY WALTER H. TRIPLETT

(With Supplemental Plate.)

Accompanying an article by Leon Guillet beginning on page 1 of the second volume of the Journal of the Iron and Steel Institute for 1906 is a chart which illustrates the mechanical properties of ternary steels.

As the curves of this chart were drawn on a very small scale, and the units were in French, it was found practical for purposes of investigation and study at the Massachusetts Institute of Technology to reproduce them in English units and on a larger scale. To do this reference was made to the original data and curves as given in Mr. Guillet's "Aciers Speciaux," Vols. I and II, Ch. Dunod, Paris, 1904-1905.

There were two complete series of tests made, one with steel containing about 0.2 per cent. carbon and the other about 0.8 per cent. carbon. The effects of the eight alloying elements upon these two series may be found in the vertical columns of the chart under their respective headings.

The mechanical properties are arranged in horizontal rows as follows: The upper row of plots illustrates the tensile properties of the first series of alloy steels having 0.2 per cent. carbon. The second row is the same for the series with 0.8 per cent. carbon. The curves in the third row show the shock-resisting properties of both series, and the curves of the last row give the Brinell hardness.

Percentages of alloying elements are marked off on the abscissae, while the mechanical units are represented by ordinates. The latter read in thousands of pounds ultimate strength and elastic limit; percentages of elongation and reduction of area; number of shocks on standard Fremont notched bars, and Brinell hardness numbers, as the case may be.

These curves are useful for studying the mechanical effects of increasing percentages of alloying elements in conjunction with the effects upon microstructure, and for determining the ranges of composition that may be used in making special steels for particular purposes.

The Great Lakes Shipbuilding Industry

Stimulated by the improvement in general business conditions and the heavy lake traffic in ore, the Great Lakes shipbuilding industry has become more active in the past few months and the outlook for 1913 in that industry is quite promising. The new year opens with 35 boats on the books of lake shipbuilders for 1913 delivery, as compared with 19 built in 1912.

The 10 years previous to 1911 constituted a memorable era of building large vessels for the lake ore trade. In that period 254 bulk freighters were added to the lake fleet. The vessel tonnage grew faster than the demand, and in 1910 many of the boats were idle for a considerable part of the season, in spite of the heavy movement of ore. Profits to vessel men were greatly diminished as compared with some of the previous years, and the investment of new capital in bulk freighters was no longer particularly attractive to interests not affiliated with the large ore shippers. This resulted in a halt in the production of large lake carriers in 1911 and only five vessels were added to the fleet of bulk freighters in that year. In 1912 only one additional bulk freighter was placed in commission.

The number of boats built by Great Lakes shipbuilders, exclusive of the Canadian yards, each year for the past 11 years is as follows:

Years	Bulk freighters	Other vessels	Total
1912	1	18	19
1911	5	19	24
1910	20	31	51
1909	17	22	39
1908	24	15	39
1907	40	16	56
1906	40	7	47
1905	29	3	32
1904	7	6	13
1903	45	5	50
1902	32	10	42

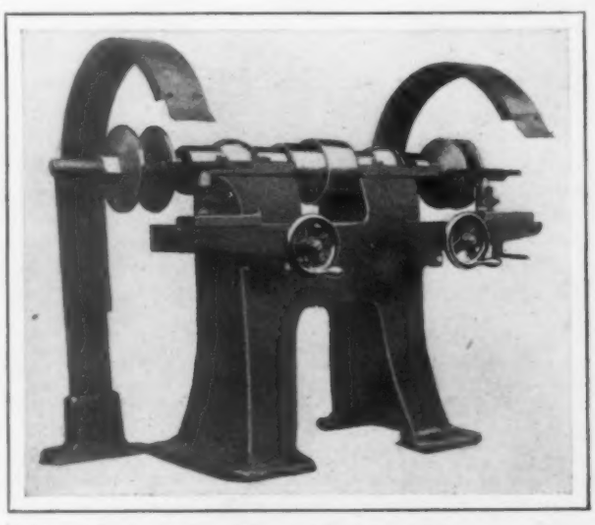
While 1912 figures show the lake shipbuilding industry at a low ebb, a revival is indicated by the fact that four large carriers are now being built by the American ship yards of the Great Lakes for the ore trade for 1913 delivery, two of which have already been launched. These will all appear in the list of vessels turned out in 1913.

In 1912 nineteen boats were built in the American shipyards of the Great Lakes as compared with 24 in the previous year. Of these one was a bulk freighter, two were passenger boats, four were oil boats, and 12 were package freight boats and miscellaneous vessels. An interesting feature of the year's lake boat building was an increase in the number of vessels built for the Atlantic coast trade. Seven 2550-ton boats were built for this trade for shipping general merchandise, and of the four oil boats built three were for the coast trade. Of the package and miscellaneous boats built, two in addition to the seven noted above were designed either for use on the lakes or for river or coast trade.

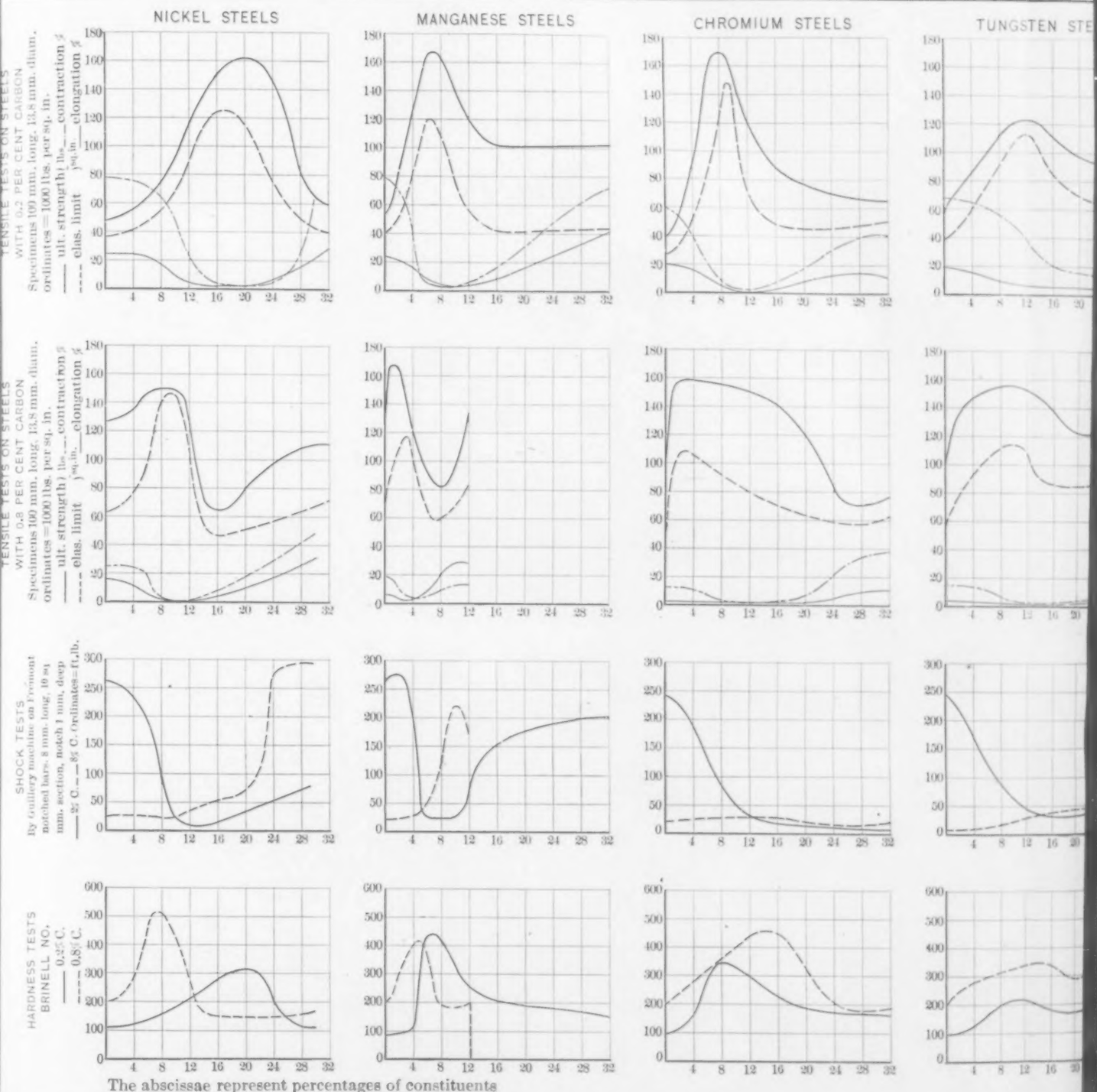
An exceedingly prosperous year is looked for by lake vessel men in 1913, in view of the expected ore movement of 50,000,000 tons, but it is believed that the present carrying capacity of bulk freighters, increased by the four boats now under construction, will be able to move this tonnage, although it will keep all the ore fleet busy the entire season. Managers of lake shipyards do not look for much additional work in the way of bulk freighter contracts for 1913 delivery, but expect a good season's business in package freighters and various miscellaneous boats, including vessels for the coast trade. Of the 35 boats already under contract for 1913 delivery four are bulk freighters, 15 are coal barges not for use on the Great Lakes, and the remainder include package freighters, two passenger steamers and miscellaneous vessels.

Challenge Emery Wheel Guard

A floor type or universal emery wheel guard has been brought out by the Challenge Machine Company, Inc., 5116 Springfield avenue, Philadelphia, Pa., which may be applied to old as well as to new grinding machines carrying wheels from 12 in. diameter upward and of any standard thickness. The guards are forged from heavy steel channel stock. They are adjustable vertically or horizontally, the latter movement being procured by blocking out between the base and the curved members. Sliding on the inner surface of the guard is a leather brush which serves as an eye guard. The device is made in sizes from 12 to 30 in.

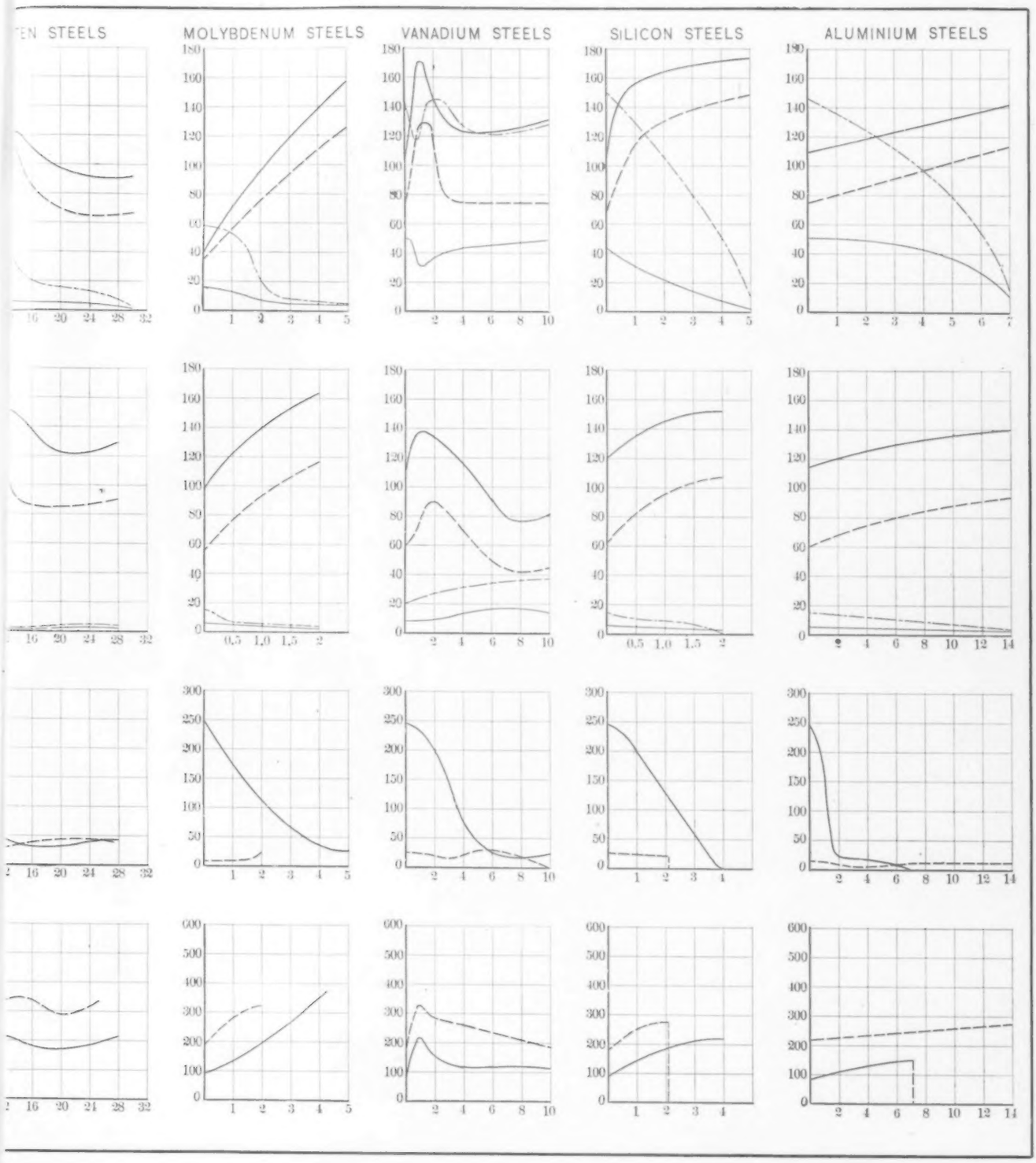


Challenge Floor Type Abrasive Wheel Guard


NICKEL STEELS
MANGANESE STEELS
CHROMIUM STEELS
TUNGSTEN STE
TENSILE TESTS ON STEELS
WITH 0.2 PER CENT CARBON
Specimens 100 mm. long, 13.8 mm. diam.
ordinates = 1000 lbs. per sq. in.
—— ult. strength; lbs.
---- elas. limit
—— contraction %
---- elongation %
TENSILE TESTS ON STEELS
WITH 0.8 PER CENT CARBON
Specimens 100 mm. long, 13.8 mm. diam.
ordinates = 1000 lbs. per sq. in.
—— ult. strength; lbs.
---- elas. limit
—— contraction %
---- elongation %
SHOCK TESTS
By Guillery machine on Frémont
notched bars, 8 mm. long, 10 sq
mm. section, notch ½ mm. deep
—— 25° C. ---- 85° C. Ordinates = ft.-lb.
HARDNESS TESTS
BRINELL NO.
—— 0.25° C.
---- 0.85° C.
0 4 8 12 16 20 24 28 32

The abscissae represent percentages of constituents

Chart of Mechanical Properties of Various Ternary Steels for Sele



Selecting Ranges of Composition for Particular Purposes

Production Efficiency in Typewriter Building

Methods Developed by the Oliver Typewriter Company, Woodstock, Ill., for Manufacturing, Assembling, Etc.— Employees' Organizations

From a beginning 17 years ago, when the building of one typewriter with the facilities at hand, was a large undertaking, the Oliver Typewriter Company has become a manufacturer of 200 machines daily. To build these machines 1000 employees are required, a small proportion of them women. Of the employees 50 per cent. have seen continuous service with the company for five years and over, 15 per cent. 10 years, and nearly 20 men have been with the company for 15 years. At the end of five years the employee is presented with a gold bar and pendant suitably engraved, and with each succeeding five years another bar is added. That this custom is but a minor incentive toward the making of the above unusual record for continuous service is obvious, but that it does offer an incentive has been amply proved. The output is interesting because of the shop methods of manufacture and assembly, methods that have for their keynote the minimum of labor for the maximum machine production, and a minimum of slack in the quantity of materials in process of manufacture.

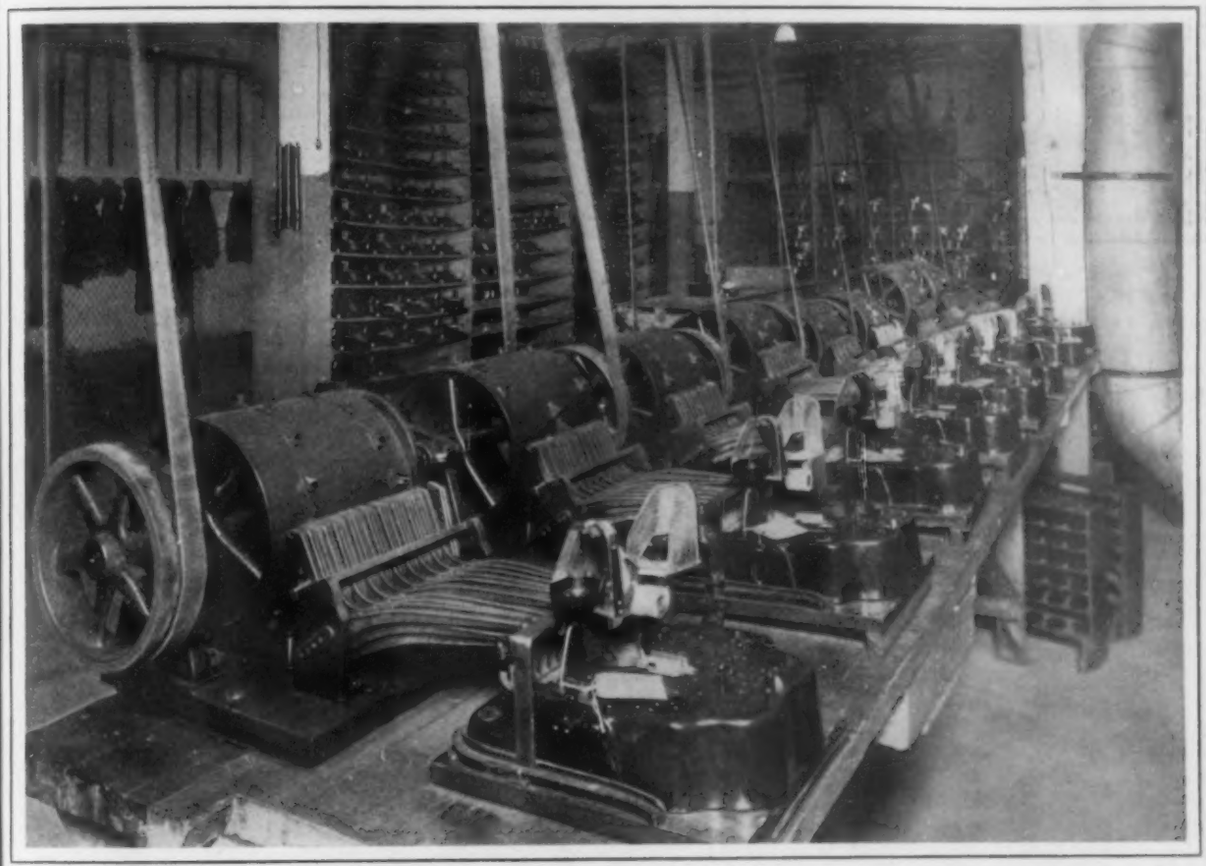


Fig. 1—Device for Exercising the Typewriter Following the Assembly of the Typebars. The Lugs on the Drum Correspond with the Spacing of the Keys

In general the manufacturing processes involved in the building of a typewriter include the making and machining of gray iron and brass castings, the blanking and forming of parts from strip steel, the working up of drill rod on screw machines into screws, studs, pins, and even the escapement, the making and setting of type, plating, and, what is of greatest importance in the avoidance of lost motion, the assembly.

The company buys its gray iron castings, the largest of which is the base of the machine. For the making of brass castings, a foundry has been built of the same general type of construction as the remainder of the plant building, having a saw-tooth roof of concrete with Hy-Rib reinforcing steel-frame work and concrete floor. The foundry is equipped with a 1-ton W. S. Rockwell oil-burning crucible furnace mounted on trunnions for tilting. The furnace accommodates one crucible in which 800 lb. of metal can be melted at each heat. The molds are made up in Modern squeezers with match plates. The punch press department is shown in Fig. 3, and also a number of the characteristic stampings which enter into the type bar and other operating mechanisms. The punch presses are all belt-driven and are equipped with a variety of safety devices for the protection of the operator in handling the work. In Fig. 5 a general view of the screw-machine department is shown, in which are included some sixty Brown & Sharpe automatic machines, four Cleveland machines and one Pratt & Whitney.

One of the most interesting of the screw machine operations is the development of the blank for the escapement. To insure absolute alignment of the pinion gear and the escapement wheel, and to prevent the possibility of this alignment being disturbed, the blank is turned from a 1 3/16-in. solid bar, the excess metal being wasted for the sake of accuracy. In mounting the blank for cutting the teeth, the piece is set with a pin hole stop so that the alignment of the piece with the cutter is identical for both gears.

The base of the typewriter, after rough-grinding, is surfaced on profiling machines and then buffed to a smooth finish. The interior of the buffing room is shown in Fig. 2. In the neighborhood of eighty holes are required to be drilled in the top of this casting, and this work is handled on the drills shown in the foreground of Fig. 4. These drills are fitted with a rotating head carrying eight spindles. It has been found that the slightly lower cost of drilling in quantity any one casting on a multiple spindle drill arranged to drill all the holes simultaneously is not

Fig. 2—The Buffing Room Using Alundum as the Abrasive, Impregnated on the Cloth Wheels with a Special Glue

sufficient to offset the lower first cost of a drill of the type shown, coupled with its flexibility in event of a change in the casting itself or the location of the holes to be drilled. The illustration covers one side of the double row of multiple spindle gang drills on which all of the drilling operations of the shop are performed.

The support on which the type bars are mounted is a brass casting in which 28 circular bearings are required to be finished with the greatest accuracy. This piece is triangular in shape and the method of machining is shown in Fig. 7. The work is done on a horizontal spindle milling machine with a wing cutter mounted on the arbor. This type of cutter, which requires the grinding of one face only, has been found to develop a more accurate bearing than is possible with the ordinary milling cutter.

It is also required to finish a series of 14 faces along each triangular side of this piece. This work is done with a special milling attachment, shown in Fig. 6, both sides being finished in one setting. This same illustration shows another operation where the finishing of two parallel faces on a small gray iron casting is required. Instead of machining this piece with milling cutters, two small rotary planer heads are mounted on the arbor in the manner shown. With this arrangement each of the tools in the cutter head can be replaced independently without disturbing the arbor, and the breaking of any one tool is

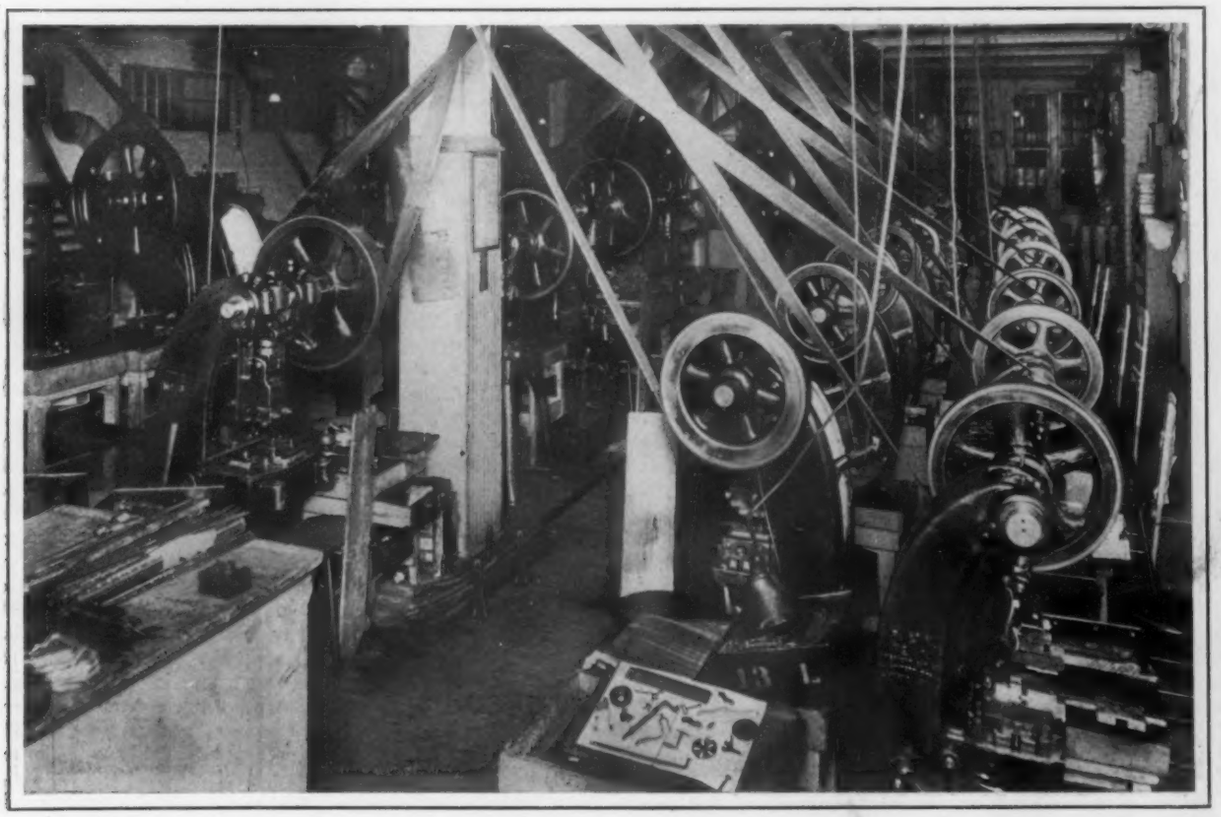


Fig. 3—Group of Blanking and Forming Presses, Segregated in One Department and Belt Driven in a Group from One Motor. Various Parts Formed from Strip Steel Shown in Foreground

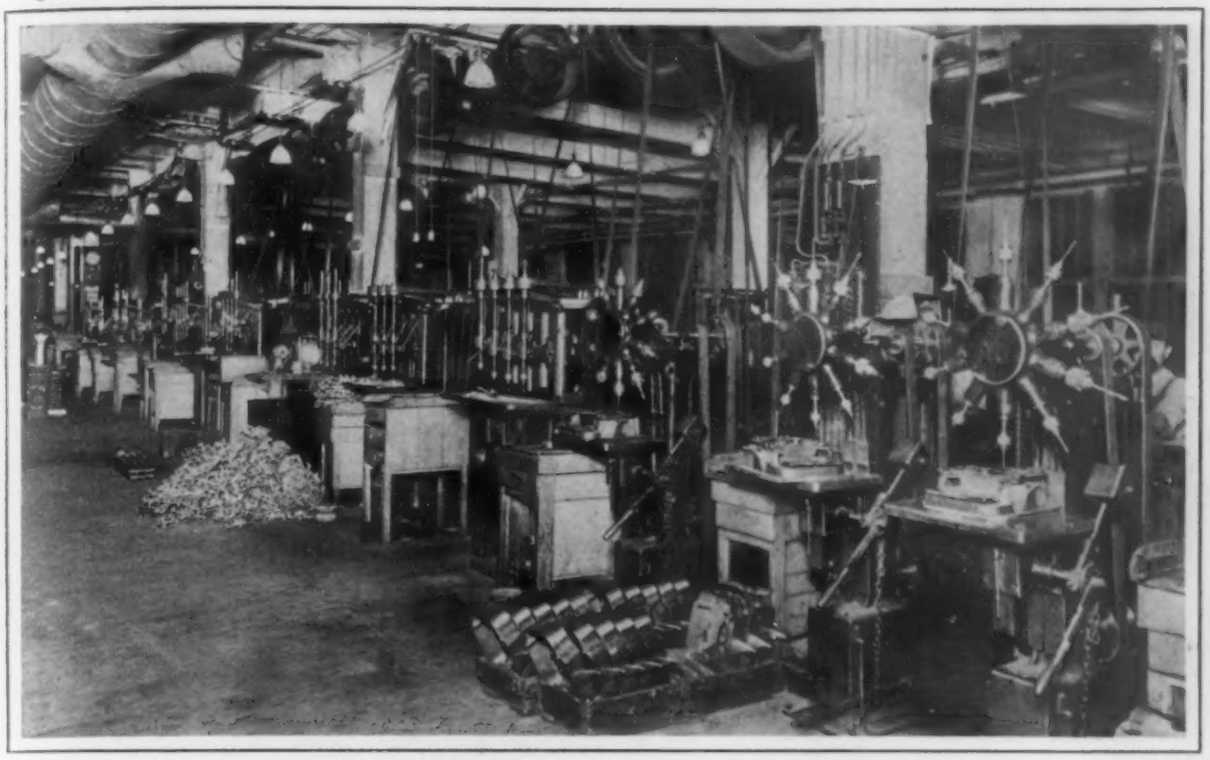


Fig. 4—One of the Two Rows of Machines Showing Two Arrangements of Multiple Spindle Drills to Accommodate the Tool to the Work

of little consequence as compared with a similar accident to a milling cutter.

Another operation which is typical of the general machining practice in this shop is shown in Fig. 8. The ten cutters mounted on this milling machine finish at one setting the brass scale rack shown in position in the illustration. In these various operations the machines are so grouped that one operator handles three and four machines setting up the work in rotation. As indicated in the various illustrations, the work is handled from one machine to another in trays and pans. Where it is convenient to do so, parts finished in one department are delivered by the workmen to a temporary stock room for semi-finished parts, this stock room being in the nature of a clearing house which issues to the operator a receipt for the number of pieces delivered, and records for the continuous inventory record the number of pieces and the manufacturing processes through which it has already passed. Where it is more advantageous, the work is moved directly from one operation to the next, being counted at the machine, but receipted for by the stock clerk in the clearing room in the same manner as all of the other material. These receipts constitute the employee's record of his work which is paid for on a piece work basis. There is prac-

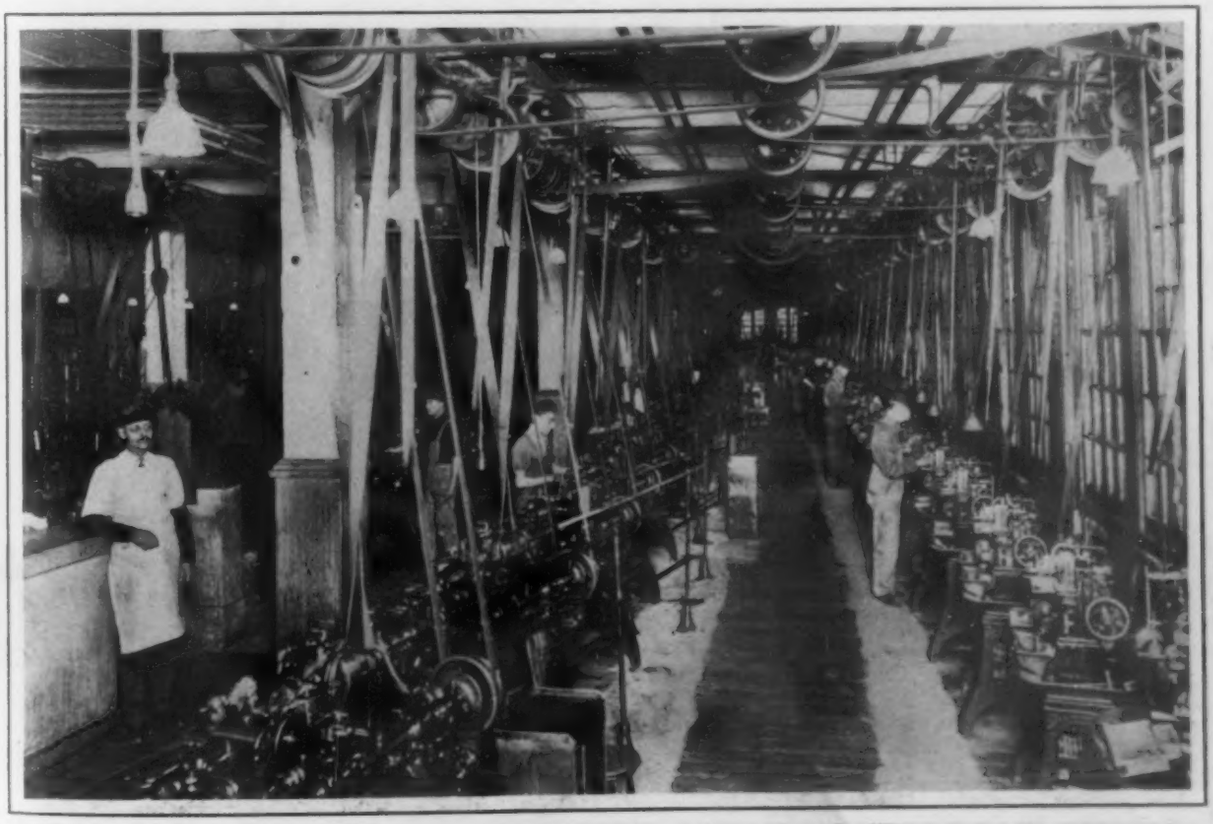


Fig. 5—Battery of 65 Screw Machines on Which the Drill Rod Stock Used Varies in Size from Wire Approximately 1/16 In. In Diameter to Rods 1 3/16 In. in Diameter

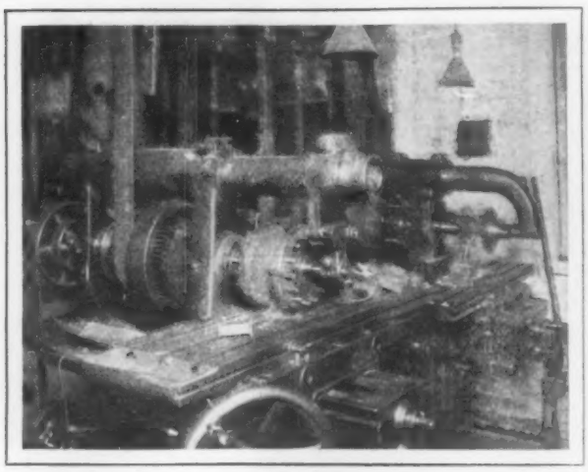


Fig. 6—View of Two Operations: The Milling Operation Consists of Machining 28 Faces, 14 on Each Side of the Piece on the Machine; the Rotary Planing Operation Finishes Both Ends of the Piece Shown at One Setting

tically no straight time work performed in the shop.

As the various parts move through the successive manufacturing operations, they are partially assembled. Both for these partial assemblies and in connection with the general final assembly, many unique and interesting mechanisms have been devised for the rapid mechanical handling of the work. In the assembly of the U-shape type bar, which is the typical feature of the Oliver typewriter, several interesting devices have replaced previous manual handling. A power screw-driver has been arranged with the aid of a simple jig for driving a number of small screws which formerly required three operators. The forming of the U-shape in the bar has now been worked out to a nicety by means of a properly formed die and roller exerting a required pressure, which results in the immediate formation with a permanent set in a single operation. The two ends of the U-shape are brazed to the tight bar shaft, and for the rapid handling of this operation a simple arrangement has been made. A quadrant, consisting of a simple wire frame mounted on a vertical spindle and also on a horizontal axis, so as to be free to rotate both in the horizontal plane and in the vertical plane, is mounted on a bench. The U-shape and the shaft of the type bar having been previously assembled and the ends to be brazed having been dipped in the brazing compound, are hung on the circumference of this wire quadrant, filling up the entire arc of the quadrant. The operator simply holds the brazing lamp with the flame at a tangent to the quadrant arc and rotates the pieces horizontally through the flame. This completes the brazing of one end of the shaft and by rotating the quadrant vertically 180 deg., and horizontally the same amount, the other end of the shaft is presented for brazing.

The type bar shaft is made from small drill rod and before assembling is required to be cut to length and fitted with two small collars which are forced on the driving fit. This entire process is performed automatically on one machine, the drill bar feeding by gravity in at one side and the collars being forced on at the other. In Fig. 1 a simple arrangement for the loosening up of the machine and for wearing down bearings is shown. A series of drums are mounted on a shaft and on the face of each drum are two converging rows of lugs, which engage consecutively long fingers that strike the keys of the machine with a motion similar to that of actual operation.

The general assembly room as shown in Fig. 10 is arranged with long benches in parallel rows. Each assembly operator performs one or a group of two or three associated assembling operations. The individual finished parts are delivered to the assembly room at an allotted location. The operator goes to this bin or tray, obtains his work, performs his particular operation and delivers the work to the next man, either directly, or by placing it in an appointed place on one of the benches. In this manner the work moves along the several rows in the assembly room to a gradually completed condition. Following the complete assembly, including the setting of the type in the type bar, the machines go through a thorough inspection and test for alignment and adjustment. Previous to this, however, in the assembly each succeeding operator is

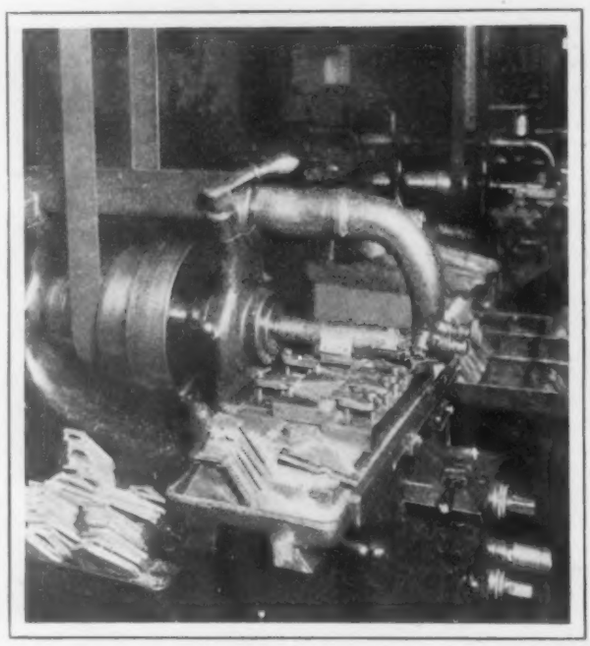


Fig. 8—Machining an Accurate Semi-Circular Bearing in Brass With a Fly Cutter

responsible for the inspection of certain preceding operations and is held responsible for the work so accepted by him.

The effect of reducing the human element in the various machining operations to a minimum, and essentially to a supervision of purely mechanical processes, and, in the assembly department, the advantage of restricting each operator to the continuous repetition of one certain operation, is a uniformity in quantity of production which permits not only a maximum output, but a maximum output from a minimum quantity of material in process of manufacture. The division of the shop into some twenty-odd departments, each submitting daily reports of material received and material delivered, makes comparatively simple the recording of a continuous general inventory, which is a complete record not only of materials, but the amount of work that has been done on them up to the day preceding.

The factory has a highly organized system of fire protection. The buildings, particularly the more recent additions, are of fireproof construction. The new floors are all of concrete, and plank floors are being replaced. The framework is of steel, the columns being entirely enclosed in tile, as shown in Fig. 9, which is a view of the nickel and copper plating room. The saw-tooth roofs are of Hy-Rib type, and the lighting panels are fitted with wire glass. The side wall windows are fitted with ribbed glass in the upper sash and clear glass in the lower. The

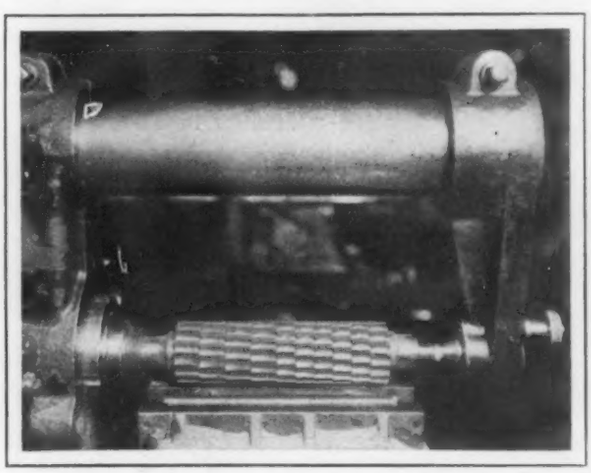


Fig. 7—Method of Cutting the Teeth in the Scale Rack. The Ten Cutters Mounted on the Arbor Complete the Operation in One Setting

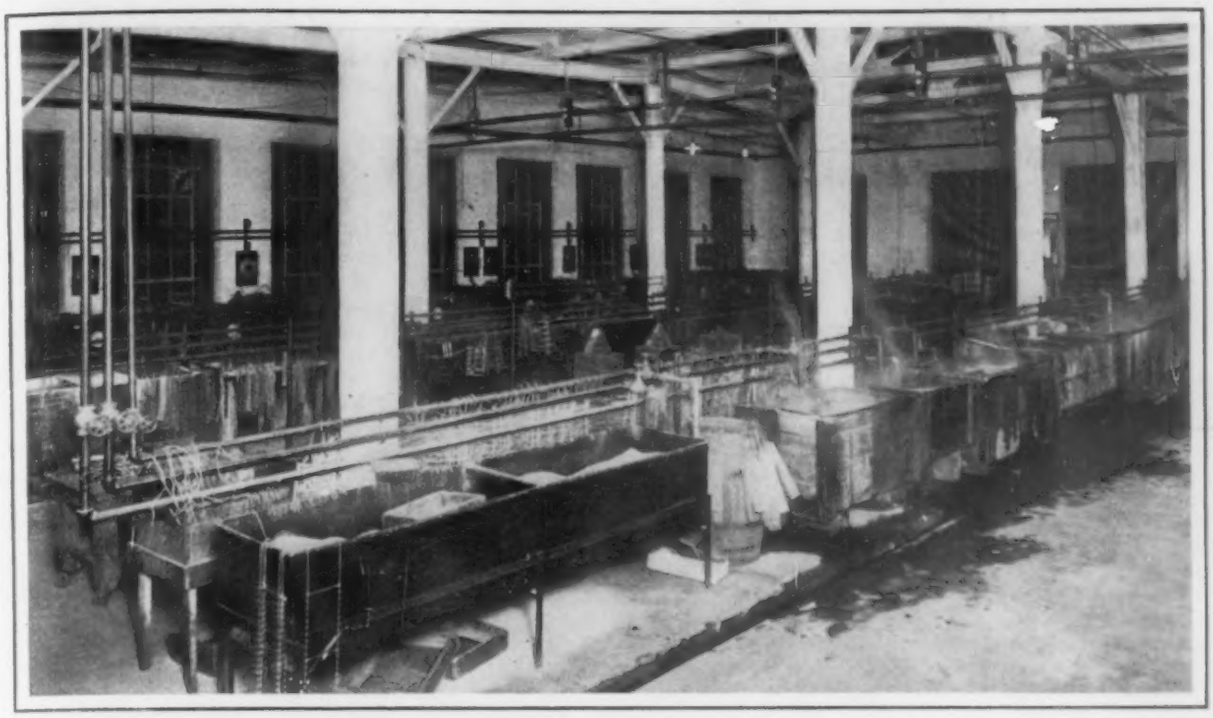


Fig. 9—The Plating Room with Concrete Floor Pitched to Drain Freely and the Plating Generators Remote from the Tanks but Busbars Used to Minimize Voltage Drop

clear glass is said to be easier on the men's eyes, and the outside view makes the shop conditions less confining.

A sprinkler system is installed throughout, and a number of fire hydrants are located inside and outside of the factory buildings. In addition to its connection with the city service, the company has intsalled a fire pump, with capacity for throwing a stream of 1400 gallons per minute, with a stand pipe pressure of 70 lb. and a reserve water tank of 125,000 gal. capacity. This fire pump is turned over every day. A fire department composed of sixteen men for special fire service and four fire policemen for regular day, Sunday and holiday service, is maintained. This fire department has its fire marshal, who is one of the foremen, and meets regularly once a week in the evening, to discuss and improve fire drills and protection. The men are paid for their time at this meeting. The men of the fire department are also given the preference where overtime or inventory work is to be done. In this way an incentive is offered to become a member of the fire department and there is always a list of applications. The men are chosen upon their general record in the shop and with a view to the accessibility of their homes to the factory.

The shop is divided into twenty-four stations, corresponding to twenty-four alarm boxes. From any of these an alarm can be turned into the engine room, and by means of a system of gong signals, the engineer gives the alarm and the members of the fire department leave their work, if in the daytime, and know at once where to go. Fire-fighting equipment is properly disposed for immediate

Fig. 10—The General Assembly Room Where the Work Moves Along the Rows of Benches Through Successive Assembling Operations, Each Operator Assembling One Part or Associated Group of Parts

use. For purposes of discipline, alarms are turned in every few days and the men go through the fire drills at full speed in any part of the shop without disturbing the general work in the slightest. At night, by means of a general switch in the engine room, each of the twenty-four alarm boxes in the factory is directly connected with the city fire department, which has a siren alarm. The company's men respond, and it handles its own fire as far as possible. The first man entering the building in event of a night alarm hangs a number on the bulletin board immediately inside of the entrance, which number indicates to those following the exact location of the fire.

The fire department also conducts a continuous inspection of fire doors, wiring, oily waste, hot steam pipes against wood, and each week all fire nozzles and fire hose are examined. For this work two men are appointed for each building. In the day time the day fireman from the boiler room is the day watchman, and twice during the day he is required to make the rounds of the shop and report on all of the sprinkler system post indicators and the fire hydrants, which report is signed and turned into the fire marshal each day.

The employees have a mutual benefit association and an excellent musical organization, every member of which is first a mechanic and then a musician. The women are, for the most part, engaged in isolated operations, and they leave the shop at noon and at night five minutes in advance of the men. In addition to the excellent natural lighting of the plant, special care has been given to the artificial lighting, and after extensive experimenting tungsten lights with Holophane reflectors spaced about 6 ft. apart, and hung about 9 ft. above the floor, were found to provide a brilliant general lighting without shadows.

Briquetting Flue Dust by Schumacher Process

In view of the great attention which is now being given to the treatment of flue dust, a brief description of the experimental plant for the briquetting of flue dust by the Schumacher catalytic process, which has been in operation for two months at the plant of the Lackawanna Steel Company, Lackawanna, N. Y., is of interest. The description, as received from the General Briquetting Company, 25 Broad street, New York, is as follows:

The flue dust is taken from the catcher at the furnace to steel bins at the briquetting plant; the coarse coke contained in the dust is separated by means of screens, with which the bins have been equipped, and is saved. Two bins are provided, each with a spout to which is attached a proportioning table, by means of which the flow of flue dust into an ordinary pug-mill is regulated. The pug-mill is a trough mixer about 10 ft. long, equipped with one shaft and a number of blades, and in this mill the dust from the two bins is intimately mixed with a solution which contains one-quarter of 1 per cent. of sulphate of iron dissolved in water, which constitutes the catalytic, and which operation represents the entire preparation of the dust.

The flue dust, so prepared, flows into the feeder, which delivers it to the press. This is a 12-mold, rotary, mechanical-toggle press of very simple design, capable of a pressure of from 5 to 8500 lb. to the sq. in., and making 20 to 22 briquettes per minute, the size being 5½ x 7½ x 3 in., and weighing about 12 lb. Due to the reaction which sets in as soon as the dust is pressed, these briquettes are quite warm. They are at once stacked up by hand in the briquetting shed and allowed to set over night. The following day they are loaded by hand into hopper bottom steel cars and then dropped into the ore bins and passed through the regular stock system.

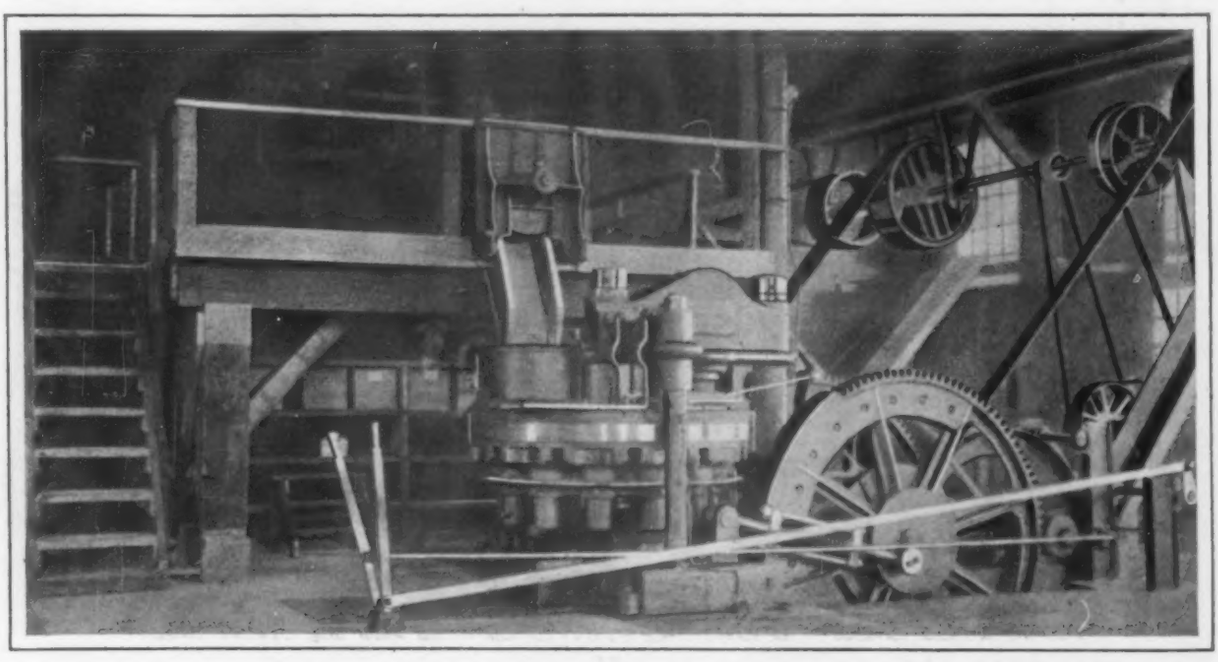
The chemical reaction (which is evidenced by the large volume of steam emitting from the briquettes) is very strong, being so great at times that the briquettes have to be sprayed with water in order to retard it. Within 24 hours the briquettes are set and hard and can be loaded, as above mentioned, and, while during this operation they will break up to a certain extent (which is quite desirable), the percentage of fines is very small.

Up to this time the plant has been running on day shift only, and the briquettes have been delivered to the blast furnace as rapidly as made. It is now proposed to run the plant on double shift, and to facilitate the economical operation, a belt conveyor is being installed to receive automatically the briquettes at the press and deliver them into cars which will be used for that purpose. It will take three to four men per shift for the entire operation.

The capacity of this one unit is 1100 to 1200 briquettes per hour, or, say, 115 to 125 gross tons per day, which would make the labor cost 10c. to 12c. per ton. It takes from 18 to 25 hp. to operate the plant. The catalytic used is a cheap by-product, the cost of which will not exceed 5c. per ton of briquettes. The briquetting of flue dust does not entail any loss of raw material. The process is very simple; the machinery is subjected to little wear; no fuel whatsoever is used; and the process, while continuous, can be suspended at any time. The resultant product embodies all the original constituents of the furnace burden in the best possible physical and chemical form for subsequent use in the blast furnace.

No experiments have been made at Lackawanna, so far, with the object of binding in fine ores or coke breeze; this, however, is contemplated, as it is successfully carried out in some of the numerous briquetting plants in Europe.

The rail mill of the Illinois Steel Company, at Gary, Ind., is stated to have broken its former record by rolling 1690 gross tons on a 12-hr. shift and 1390 tons on the next.



Schumacher Flue Dust Briquetting Machine at Lackawanna, N. Y.

Heat Treating at an Automobile Engine Plant

Notable Installation for Tempering, Heat Treating and Case Hardening at Works of Continental Motor Mfg. Company, Detroit

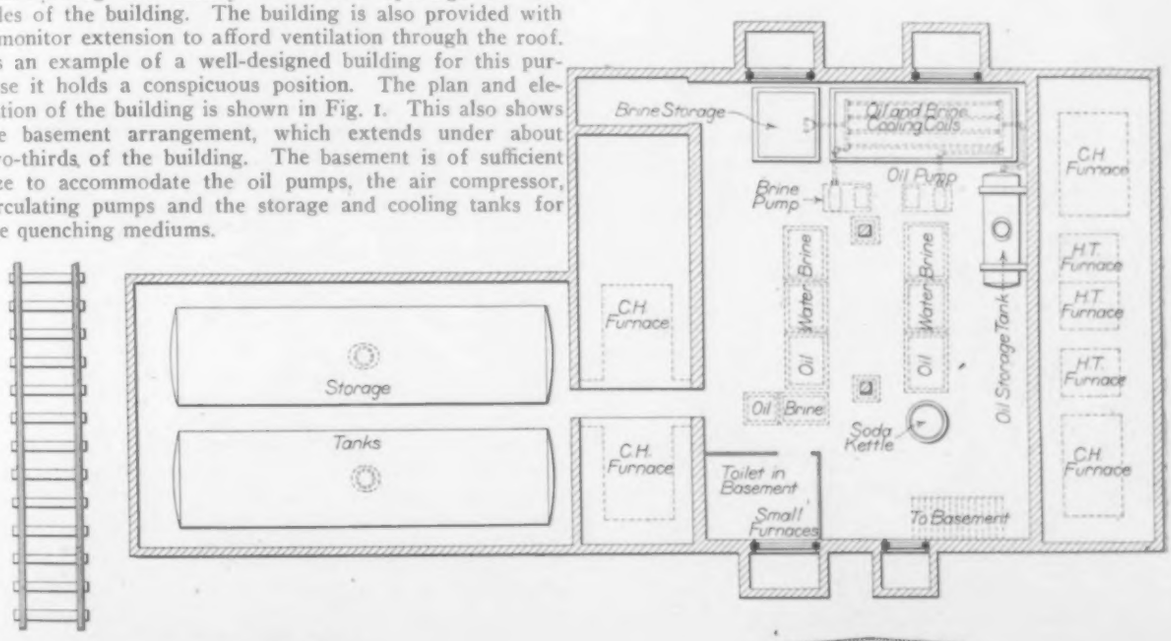
The ever-increasing necessity of giving proper heat treatment to steel has resulted in much more thought being given to the heat treating plant than formerly. While heretofore a furnace and a quenching tank were installed in any place where there seemed to be room, and was called the heat treating department the matter now is considered of too much importance to locate such a department in an out of the way place.

An example of a well-designed and constructed heat treating plant is found in the works of the Continental Motor Mfg. Company, at Detroit, Mich. The company manufactures gasoline engines for automobiles, so that the parts which go into the heat treatment are engine parts only. These parts include camshafts, timing gears, piston pins, crankshafts, connecting-rods and small bolts and screws. The bulk of the work is case hardening and most of the parts heat treated are small in size.

The building designed for the department is 40 x 50 ft., with a structural steel frame and brick side walls. The side walls are extended up from the foundation to about the hight of a man's head. Above the walls are metal window sash of the rolled steel type which extend to the eaves. The sash is provided with ventilating sections which swing horizontally and afford openings for the sides of the building. The building is also provided with a monitor extension to afford ventilation through the roof. As an example of a well-designed building for this purpose it holds a conspicuous position. The plan and elevation of the building is shown in Fig. 1. This also shows the basement arrangement, which extends under about two-thirds of the building. The basement is of sufficient size to accommodate the oil pumps, the air compressor, circulating pumps and the storage and cooling tanks for the quenching mediums.

up from the floor in order to maintain the high and sustained temperatures necessary in this class of work. The heat-treating furnaces are lighter in construction than the case-hardening furnaces, owing to the lower temperatures required. Temperatures low enough for tempering purposes are at times necessary to be maintained in these furnaces. All of the furnaces have shown a very uniform temperature in service. The extreme variation in the different parts of the heating chamber probably does not exceed 20 deg. The hearths of all the furnaces are at a uniform hight from the floor and also the same hight as the packing table, where the material for carbonizing is packed. The door openings are the full width of the heating chamber and are heavily lined to prevent radiation. The doors are counterweighted to insure ease of operation.

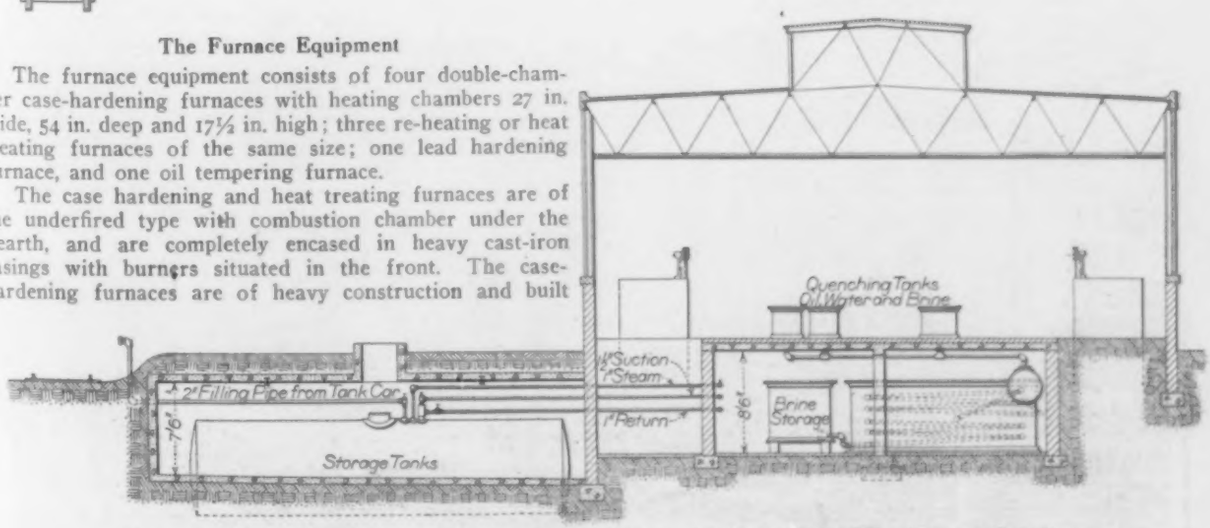
The floor arrangement of these furnaces is shown in plan in Fig. 1, and those that are situated on the east side of the building are shown in Fig. 2. In the latter the case-hardening furnaces are shown on the extreme ends and the heat treating furnaces in the center. The tables for packing the carbonizing boxes are located along the north wall of the building.



The Furnace Equipment

The furnace equipment consists of four double-chamber case-hardening furnaces with heating chambers 27 in. wide, 54 in. deep and 17½ in. high; three re-heating or heat treating furnaces of the same size; one lead hardening furnace, and one oil tempering furnace.

The case hardening and heat treating furnaces are of the underfired type with combustion chamber under the hearth, and are completely encased in heavy cast-iron casings with burners situated in the front. The case-hardening furnaces are of heavy construction and built



Plan and Sectional Elevation of the Heat-Treating Plant of the Continental Motor Mfg. Company, Detroit

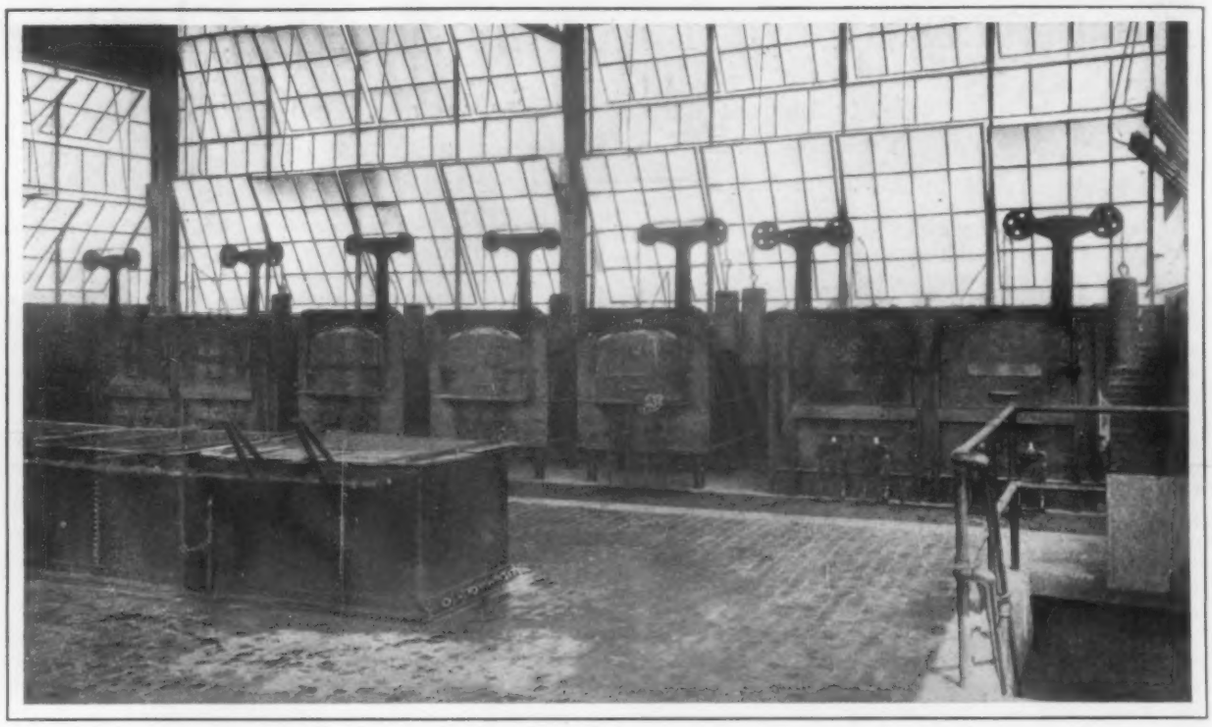


Fig. 2—Two Case-Hardening Furnaces at Each End, Heat-Treating Furnaces in the Center and Quenching Tanks in the Foreground

Control of Temperature and Quenching System

Each furnace is connected with the pyrometers which are situated on the north wall of the building. These pyrometers are of the Bristol type and each pair of case-hardening furnaces is furnished with a recording and indicating instrument. One indicating instrument with the necessary switchboard is used for all the heat-treating furnaces where the heats are of short duration.

There are three quenching mediums used—water, oil and brine. The quenching tanks are of special design and placed so that they are readily accessible to the furnaces. Each quenching tank is 32 in. wide, 48 in. long, 42 in. high and has a capacity of about 250 gal. The design insures the minimum variation of temperature of the quenching medium.

The detailed arrangement of the tanks is shown in Fig. 3. As will be noted, the incoming liquid is distributed through a perforated pipe running under a false bottom. This bottom is made of wood in order to take the shock of anything dropped into the tank. The temperature of the quenching bath is regulated by the rate of flow. This is governed by a valve situated on the inlet pipe, and is entirely at the will of the operator. The overflow is in the form of a manifold and is intended to remove the liquid from the entire surface at a uniform rate.

The oil-quenching tanks are provided with a specially designed hinged and divided smother cover, as shown on the first tank in Fig. 2. This cover is either thrown back up on its supports or drawn over the tank at the will of the operator. An eyehole in the front of the cover enables the operator to close the tank quickly from either the front or back without danger to himself should the oil catch fire. All tanks are of sufficient depth to quench vertically any work necessary.

The water in the water tank is taken from the city mains and varies in temperature with such supply.

The oil and brine are separately cooled by passing through cooling coils situated in the large cooling tank in the basement. This tank is connected with the city mains and the cooling water is kept in constant circulation. The arrangement is shown in plan and elevation in Fig. 1. A supply of excess quenching oil and brine is kept constantly at hand, the former in a storage tank of approximately 450 gal. capacity, the latter in a storage tank of approximately 900 gal. capacity.

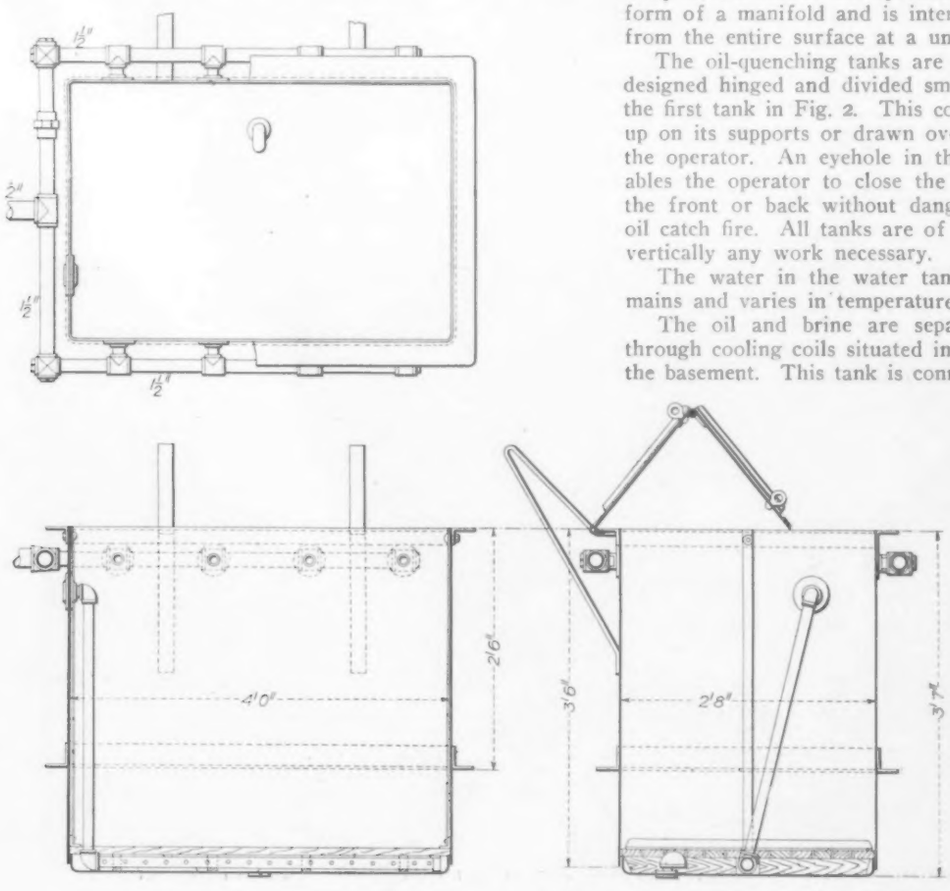


Fig. 3—Details of the Quenching Tanks

The circulating pumps for the quenching oil and brine are shown in the foreground of Fig. 4, which is a view of the complete basement equipment. These pumps are of the centrifugal type,

moving a large amount of the liquid which automatically discharges back into the proper storage tank if use is not made of it in the quenching tanks.

Fuel Oil and Compressed Air Systems

Oil is used as fuel and delivered directly from tank cars into two large storage tanks of approximately 11,000 gal. capacity each. These tanks are situated in a pit outside of the building and the oil piped in through the side walls into the basement. The oil pumps are of the rotary type and are mounted on the side wall of the basement, as shown in Fig. 4. These pumps were built by the Deming Company, Salem, Ohio. They deliver the oil under constant pressure to the burners and are provided with an automatic overflow or relief valve which permits the excess of oil to pass back into the supply tanks. Fig. 5 shows another view of the oil pumps.

The air for atomizing the oil is furnished at a constant pressure of 2 lb. by a General Electric turbo air compressor. This compressor is situated in the basement, as shown in Fig. 4. The blast lines are of spirally riveted pipe large in size up to a point near the furnace, where they are reduced to a suitable size for the burner. The piping of all systems is either in an exposed position in the basement or in conduits, which arrangement renders it at all times accessible. It will be noted that all of the pumps and the air compressor are direct motor driven, the current being furnished from the company's power house.

The building for this plant was designed by H. C. Spillman, plant engineer of the Continental Motor Mfg. Company. The equipment was designed and installed by the American Shop Equipment Company of Chicago, Ill. The consulting engineer was James H. Herron, metallurgical engineer, Cleveland, Ohio.

A New Johns-Manville Factory

The completion of the new factory of the H. W. Johns-Manville Company, at Manville, N. J., marks another important chapter in the history of this enterprising concern. Beginning with the consolidation of the H. W. Johns Mfg. Company and the Manville Covering Company, in 1901, the H. W. Johns-Manville Company has rapidly grown until today it ranks as the largest establishment in the world engaged in the manufacture of asbestos and magnesia products. It has branch houses in practically every city of prominence in the United States and Canada, and representatives in almost all foreign countries. Its manufacturing plants are located in Brooklyn, N. Y.; Milwaukee, Wis.; West Milwaukee, Wis.; Hartford, Conn.; Nashua, N. H.; Lockport, N. Y.; Jersey City, N. J., with an asphalt refinery at South Amboy, N. J. Its asbestos mines at Danville, Province of Quebec, Canada, are said to be the largest in existence, producing the finest grade of asbestos known.

The new Manville plant consists of nine buildings, which are classified as follows: A, textile and packing; B, rubber plant, electrical specialties and printing department; C, pipe coverings; D, paper mill; E, magnesia;

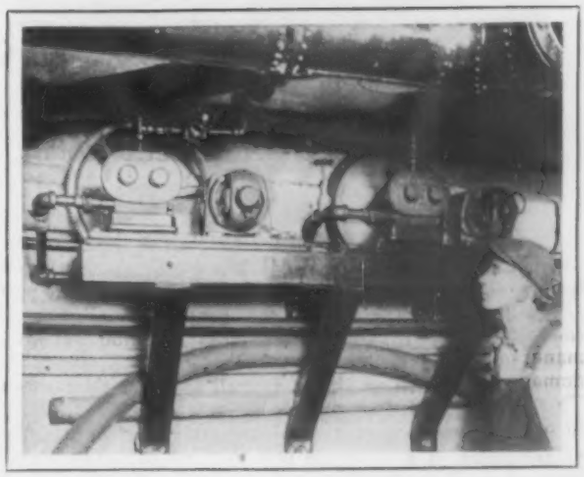


Fig. 5—The Fuel Oil Pumps with Their Bracket Support

F, roofing; G, mastic and waterproofing; H, roofing coatings, power plant and pump house. These buildings represent the most advanced ideas in fireproof construction, being of brick, steel and concrete, with roofs of J-M asbestos roofing. They are planned not only for safety but to afford the best operating conditions for the employees. The "daylight" form of construction, which is employed throughout, permits a flood of light to enter the buildings through large triple-unit windows placed close together. The walls, ceilings and uprights are coated with J-M fireproof cold water paint. Artificial illumination is provided in the form of J-M Linolite lamps and Frink reflectors. The buildings have an average length of 1000 ft. and each is a separate factory in itself, capable of being operated as an independent unit without relation to the other buildings in the group. The total floor area is about 1,000,000 sq. ft.

The power plant is equipped with General Electric turbo generators and six Babcock & Wilcox high-pressure water-tube boilers aggregating 5000 hp. All steam pipes are insulated with J-M asbesto-sponge felted covering in order to effect a maximum saving of fuel. The power and lighting cables, instead of being strung on overhead poles, as is generally the case in factory installations, are led underground through J-M fibre conduit, thereby eliminating cable troubles for all time. The buildings are heated by exhaust steam conveyed underground from the power plant through pipes laid in J-M sectional conduit.

The location is on a picturesque tract of 320 acres, divided by the Raritan River, in the town formerly known as Findern, N. J., but which name was changed to Manville. The company's private railroad system, comprising five miles of tracks, connects directly with the Central Railroad of New Jersey, the Lehigh Valley and the Philadelphia & Reading, thereby insuring excellent shipping facilities.

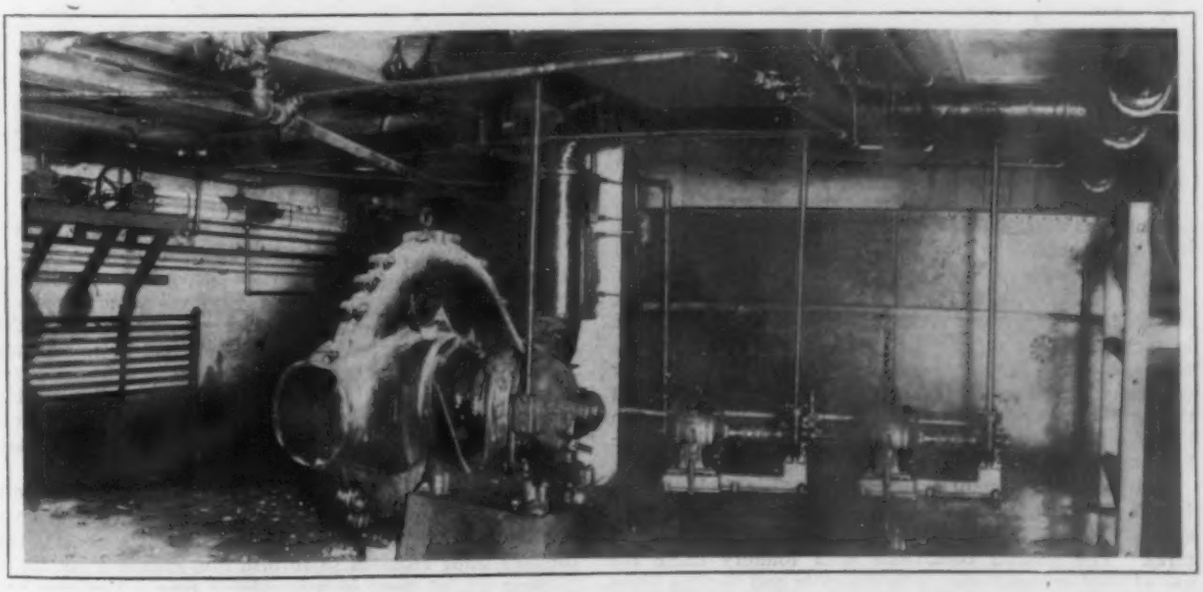


Fig. 4—Circulating Pumps and Air Compressor in the Basement and Oil Pumps on Side Wall to the Left

S. DIESCHER & SONS.
Mechanical and Civil Engineers,
PITTSBURGH, PA.

A New Stove Foundry at Chicago

Plant of Cribben & Sexton Company—Automatic Buffing Machine and Portable Bench Work Among the Features

The new plant into which the Cribben & Sexton Company, Chicago, transferred its stove-making operations last year is an interesting example of the important part ample floor space plays in the general simplicity and convenience of foundry operation. The line of work manufactured includes all of the ordinary types of domestic coal burning stoves as well as a hot-air furnace. The molding is entirely matchplate and followboard work, including bench, squeezer molding and floor work. The arrangement of floor space provides for the grouping of each class of work with unobstructed approaches to the pouring floors from the cupolas, the heavy molds being made up nearest the cupolas.

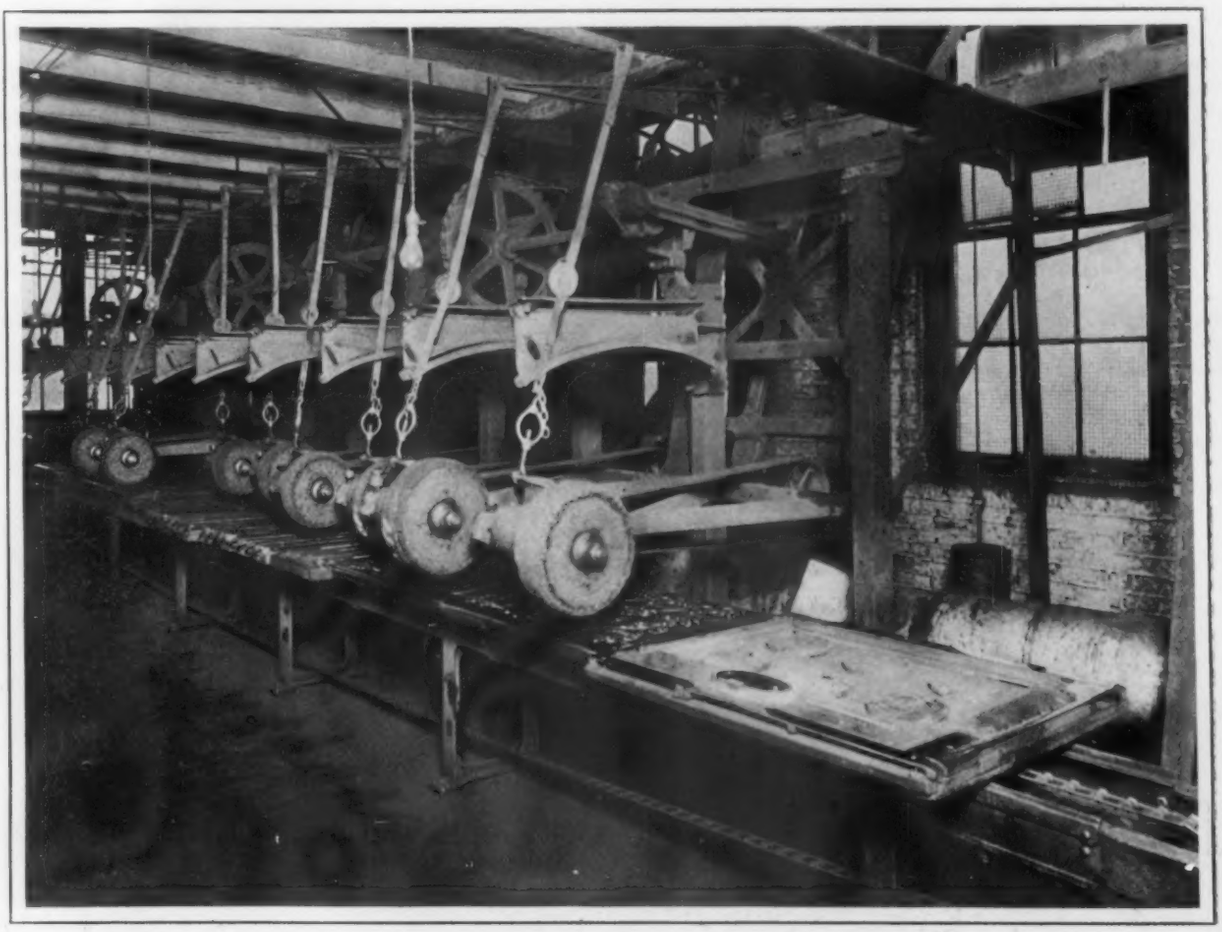
The foundry building has a steel skeleton with brick walls. The roof is a sawtooth frame construction carried on 24-in., 80-lb. I-beam girders which tie in the steel columns. The columns are spaced at intervals of 20 ft. in a longitudinal direction, and across the shop divide the floor space into six longitudinal bays, 35 ft. 6 in. and 44 ft. 6 in. in width. The clear hight from the floor to the roof beams is 19 ft. 6 in. at the sides and 21 ft. 6 in. in the center, the resulting roof pitch taking care of the drainage. The building is 240 x 325 ft., the former dimension being in an east and west direction, so that the lighting panels of the sawtooth roof receive the north light. The entire floor is of concrete, the molding floor being 1½ in. below the level of the gangways.

The general type of construction, while lacking uniformity with attendant disadvantages to which objection might be raised, offers certain conspicuously desirable features. The general conditions in a foundry make the use of steel columns obviously desirable and for the hight obtained in this building are practically as cheap as any form of framing. The use of frame construction in the roof is decidedly cheaper than steel, and being considerably lighter, permits the simple I-beam girder construction which not only enhances the lighting effect as compared with a trussed roof but contributes to the greatest clear hight in the foundry with a minimum hight of column. The plans were prepared by Henry Siercks, Chicago.

Cupolas on a Central Line

Following the best modern practice, the cupolas are located on the median line of the foundry 150 ft. apart, so that each is centrally located in the floor it serves. They have a diameter of 84 in. and were built from the Cribben & Sexton Company's design. They are lined down to 48 in. and each is fitted with six Zeppler tuyeres. The blast is supplied by Root's positive blowers, motor driven. An industrial track runs through the center of the foundry and out into the pig iron, coke and limestone storage yard. These materials are brought in on trucks and run on an elevator for each cupola and by this means raised to the charging floors. The foundry entrance from the storage yards being in constant use, it has double swinging doors, reinforced and protected with a steel plate so that trucks or wheelbarrows push right through without the formality of waiting to have them opened.

The hot metal is poured directly from the cupola spout into 50-lb. hand ladles, and in accordance with contract regulations the molder pours his own molds, the foundry being required to furnish him sufficient hot metal to pour off his floor in a stipulated time. The men are



View of the Multiple Automatic Buffing Machine

divided in groups, and each gets a ladle of iron in regular rotation so that all finish pouring at approximately the same time. The two cupolas are now melting about 50 tons of iron daily, and the iron analysis is approximately silicon 2.50 to 2.60 per cent.; phosphorus, 0.01 per cent., or slightly under, and manganese, 0.55 to 0.60 per cent.

The bench work of the foundry is confined to the east bay, extending for the greater portion of the entire length of the building. A general view of this floor is shown in one of the accompanying illustrations. The molder's bench is mounted on rollers and straddles the molding sand, which is laid in a long pile running out from the wall. The molder moves his bench back toward the wall as he fills up his floor. In the foreground are shown some of the matchplates that are typical of the work handled on the bench with hand ramming.

The squeezer floor occupies the adjoining bay. The molding is all done on matchplates. The flasks have a triple hinge, which not only allows the two parts to swing freely, but accommodates the matchplate. The squeezer machines are of the Arcade type. For somewhat similar work a Modern molding machine has been installed, and on this machine from 125 to 160 molds are made in a day, the number depending on the character of the work.

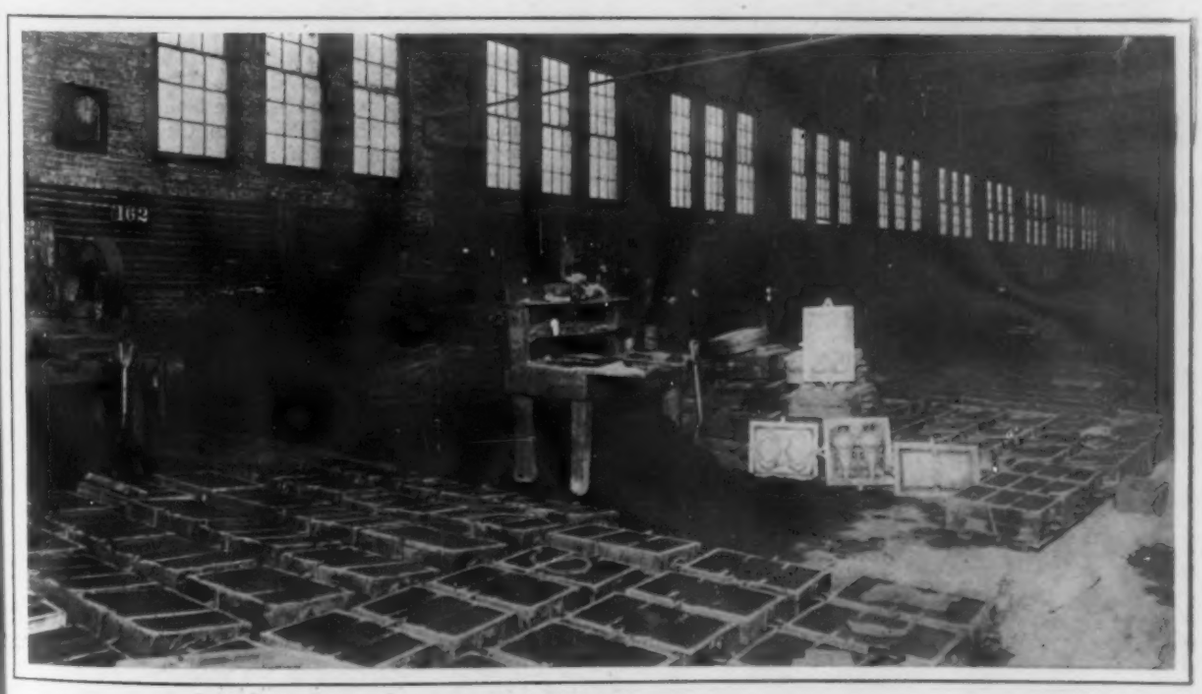
The floor work, which occupies almost the entire remaining half of the foundry, is made up with follow-boards, most of the floor molds also being handled in hinged flasks. Each man's floor has its number hung conspicuously from the girder. Each piece he makes bears that number which identifies his work for credit. Like all of the other work in the foundry, the floor molding, with the exception of the dome and fire chamber

View of Furnace Dome Molding and Hoist Equipment

for the hot-air furnaces, is on a piece rate basis. For the present this latter work is being done on straight time. In one of the cuts are shown the metal pattern for the furnace dome, and also a similar pattern with the cheek of the mold in position. This mold is put up in a three-part flask and for handling it Curtis & Co. Mfg. Company floor-operated cranes have been installed. From these are hung Chicago Pneumatic geared air hoists. The air is supplied by the latter company's straight line compressor, motor driven and delivering 270 cu. ft. of air at 110 lb. The control equipment for the compressor consists of a Cutler-Hammer cutout solenoid and starter.

Finishing the Castings

The molder shakes out his flasks and delivers the castings to the central track, whence they are trucked directly to the cleaning room at the north end of the foundry. The castings come from the foundry fairly free of sand, but are put through tumbling barrels, of which there are 20 in the battery. The breakage in these rattlers is less than 2½ per cent. of total castings. At the opposite end of this room the grinding equipment for removing fins and rough spots is installed and includes seven double-end and vertical disc grinding machines. The drive is grouped and belt connected to motor. From the cleaning room the castings are trucked through a connecting tunnel into the main warehouse building, a four-story structure 100 x 480 ft. The parts to be nickel-plated are handled at once in this building, the equipment being of the customary character. Three Hanson & Van Winkle nickel-plating sets supply current at 12,500 amperes and 6 volts. The generators are immediately adjacent to the tanks to minimize voltage drop. For the removal of



View in Foundry Where Bench Molding Is Done, Showing the Portable Bench

grease from the castings before they enter the nickel salt solution they are immersed in water with current reversed.

Immediately adjoining the nickel-plating room is located the buffing equipment for the small parts. This consists of 35 double-end wheels with the Cyclone system of induced draft for removing the dust. The larger flat castings are taken to the automatic buffing machine, shown on page 74, which was designed by this company. It consists of a series of buffing and polishing wheels arranged consecutively to give the several finishing operations. The castings mounted on the table are moved automatically by means of an endless chain. The table accommodates ten sets of castings, the finishing of which is accomplished in approximately one hour.

The sheet metal department in which the stove linings are fabricated is equipped with power metal working machines manufactured by the Excelsior Tool & Machine Works, St. Louis; Rudolphi & Krummel, Chicago, and the Niagara Machine & Tool Works. The sheets are worked up entirely from templates, a collar being placed around each hole, fitting the punch stem and centering the hole. This department is located at the south end of the main building and the finished linings are worked toward the assembling room at the center, whence the castings are brought from the opposite end of the structure. On the floor immediately below the hot air furnaces are assembled. From these rooms entrance is had to the elevators to the stock rooms above. Thus the raw materials, starting in the foundry and in the south end of the main building, pass through the various manufacturing operations and meet in the center of the warehouse.

Special Cam Cutting Fixtures

The 6-in. cam-cutting machine shown in the illustrations has been equipped by its builder, the Garvin Machine Company, New York, with a face cam and barrel fixtures. In the face cam equipment the blank is mounted on the inner end of the arbor A with the former on the outer end. The arbor is driven by worm and worm gear from the universal joint feed shaft shown at the front of the machine. The work arbor arm pivots on its forward end at B and is guided at the rear end by guides mounted on the same table. In addition to its own weight the arm has detachable weights to maintain the former on its roller, offsetting the stress of the cutter. The fixture is a unit in itself; the entire slide may be drawn off or the top of the knee, the universal joint shaft being detachable.

The Garvin Face Cam Fixture

The Garvin Barrel Cam Fixture

In the barrel fixture at the end of the arbor C is mounted the work and on the other end at D is the former, which is held against the rail by the adjustable spring tension rod E. In both attachments the feed is disconnected by the clutch F which gives hand control from the wrench point G. In the barrel fixture quick returns are employed at times, requiring a quick let-up of tension contact of former and roll. This is taken care of by means of a crank on the pinion shaft H, which eases off the spring pressure. The spindle takes No. 7 B. & S. shank cutters. All gearing is housed and free from damage to itself or injury to the operator. The weight of the machine complete is 850 lb., and the floor space required is 36 x 43 in.

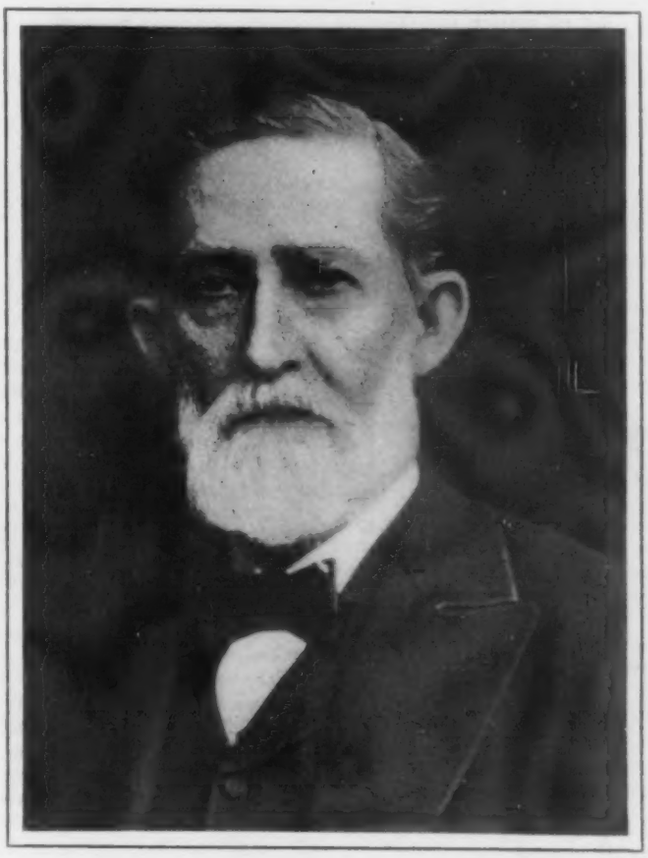
Prison Made Binder Twine.—At the monthly meeting of the Manufacturers' Club of Terre Haute, Ind., Kirk W. Perley, sales agent for the binder twine made at the Indiana State Prison, Michigan City, explained how the product was disposed of and told of the proportions of the industry. He said that 3,000,000 lb. was manufactured last season and that the Board of State Control had authorized the building of another mill to increase the capacity of the prison plant to 6,000,000 lb. annually. There is no other binder twine factory in Indiana. The twine is sold at 6½c. per lb. to the farmers of the State, considerably less than they had formerly paid. They use about 9,000,000 lb. annually. The superintendent and foreman of the plant are paid salaries; the workmen are the prisoners serving long sentences.

The various civic bodies of Indianapolis, Ind., have been merged into one, to be known as the Indianapolis Chamber of Commerce. Charles C. Hanch, treasurer of the Nordyke & Marmon Company, manufacturer of automobiles and flour milling machinery, has been elected president of the new organization.

The J. Lipsitz Company has purchased a tract of land adjoining its scrap yard at Chelsea, Mass., and will extend it with larger track room in the next few weeks. Additional machinery is to be installed for greater convenience in handling scrap.

James M. Swank Retires

With the close of 1912 James M. Swank has been re-ved, at his own request, of the exacting care attending e collection of statistics of the iron trade at home and road and the performance of those other important ties which for 40 years attached to his position as secre-ry or general manager of the American Iron and Steel ssociation, Philadelphia. Mr. Swank is now over 80 ars old, and has well earned his retirement. His services the iron trade would have warranted his giving up ac-e duties years ago with high honors for his meritorious ork. He chose, however, to continue in harness when thers of his years would have gladly sought respite from egular occupation.



James Moore Swank was born in Westmoreland County, Pennsylvania, July 12, 1832. His great grandfather on his mother's side, John Moore, was a member of the Pennsylvania Constitutional Convention of 1776, was subsequently the first president-judge of Westmoreland County, and afterward was a member of the State Senate. When James was in his seventh year his father removed his family to Johnstown, Pa. He was clerking in his father's store, in his twentieth year, in 1852, when he was asked to take charge of the local Whig newspaper, which was without an editor, and thenceforth for many years he was its editor and publisher. This paper was for a time known as the Cambria Tribune, and afterward became the Johnstown Tribune, under which name it is still published. Parting with the Tribune in December, 1869, Mr. Swank passed the next three years in Washington, D. C., first as clerk of the Committee on Manufactures of the House of Representatives, and afterward as chief clerk of the Department of Agriculture. In December, 1872, he resigned the last named position to take charge of the work of the American Iron and Steel Association, which has always had its office in Philadelphia. His career since then is well known to the members of the iron trade.

Mr. Swank was specially qualified for his duties in charge of the affairs of the American Iron and Steel Association. Being a journalist by profession, he thoroughly understood the work of preparing and printing the various publications of the association. Brought up in an iron town, he was familiar with manufacturing conditions and was an ingrained protectionist. In the early years of his connection with the association, the tariff question was ever prominent and he was steadily called upon to prepare arguments in favor of the protective policy and to furnish statistical and other information to protectionist members of Congress. Mr. Swank was alert in perceiving the strong points of protection and any weaknesses in the arguments of its adversaries. He was untiringly in correspondence with men of prominence in all parts of the country, fortifying the work of protection in localities where it was weak and encouraging the efforts of those who were writing arguments in its favor. In every national campaign he distributed great quantities of protectionist literature. Meanwhile, his interest in the purely statistical work of the association never flagged. From year to year the statistics of the iron trade collected by him became more comprehensive and more valuable. His statistical reports won commendation at home and abroad, and to-day he stands as the most eminent iron and steel statistician the world has ever known.

In addition to the work performed, as indicated above, Mr. Swank found time for more general literary achievements. In 1878 he published in book form an "Introduction to a History of Iron Making and Coal Mining in Pennsylvania," in which he presented many facts regarding the pioneers in the manufacture of iron and steel in this country, putting these facts in connected and permanent form. In 1891 he brought out his most ambitious work, entitled, "Iron in All Ages." Numerous other works have been issued by him dealing with literary matters or with personal reminiscences.

No man has written more lovingly of his native State and its people than has Mr. Swank. Throughout his life he has seized every chance to extol the greatness of Pennsylvania and the achievements of its citizens. His love for the home folks manifested itself again and again. One of his most interesting works is the volume entitled "Cambria County Pioneers," in which he gives biographies of men who were prominent in the founding of Johnstown and in developing the resources of the region which is now chiefly known through the location there of the great establishment of the Cambria Steel Company.

While he has retired from regular duties, it is understood that Mr. Swank will still continue to give the benefit of his long experience in the management of the American Iron and Steel Association to those who will continue his statistical work in connection with the American Iron and Steel Institute.

Price of Metal Hose Reduced

The cost of metal hose to the consumer has decreased in a material way in recent years. Previous to its manufacture in the United States it was imported in moderate quantities but the price was so high as to be almost prohibitive, in spite of the fact that its suitability for carrying oil and steam was most pronounced, especially on account of a long life as compared with rubber. Therefore the effort of the manufacturers has been to bring the price down to a point where a general adoption of the hose would be possible and this has been accomplished. A further material reduction, effective January 1, is announced by the American Metal Hose Company, Waterbury, Conn. Prior to three years ago the only hose of this description manufactured in America was that used in connection with automobile horns and speedometers. To-day this company is operating a large factory where, in addition to the line of small tubing, there is manufactured flexible metal hose suitable for practically all the purposes for which rubber hose is used. The growth of this business in the year has been large, and 1913 is expected to be very much larger because of the radical decrease in prices.

The Pittsburgh Iron Trade in 1912

BY ROBERT A. WALKER

When 1911 closed, some signs were apparent of awakening activity in the iron trade, but even those who were most sanguine regarding prospects have been surprised by the wonderful activity of the last eight or nine months of 1912. When the year opened, conditions were only moderately active. A few scattered blast furnaces that had been idle were blowing in, and the pig iron output was thus slightly increasing. The year was not very old, however, when the makers of iron and steel began to experience an increased demand for their products, and by the time early summer was reached the iron trade was in full swing, and during the summer and fall months it reached the point where consumers were not so much considering the matter of prices but of getting the material they needed.

The preceding years of 1910 and 1911 had been lean ones, railroads buying practically nothing and general consumers of iron and steel making purchases with much caution and seeking the lowest sellers. Prices on all kinds of iron and steel products at the beginning of 1912 were very low. Bessemer pig iron was selling at about $14, at Valley furnace; Bessemer and open-hearth billets, at about $20, Pittsburgh; steel bars, plates and shapes, at about 1.10c., Pittsburgh; No. 28 black sheets, at 1.90c., Pittsburgh; tin plate, at $3.40, per base box, Pittsburgh, and prices on all other lines were relatively as low.

In the latter part of 1911 and early in 1912 consumers reached the conclusion that prices were probably as low as they would go, and a buying movement set in that soon filled the mills with work for a considerable period ahead. Once this buying movement started it gained momentum. The railroads, whose abstention from buying had been keenly felt in 1911, came into the market for rolling stock, track material and shop supplies, thus greatly increasing the volume of iron and steel business. In the summer and fall months the leading makers of iron and steel were not only obliged to run their works to full capacity to meet the demand but booked heavy contracts for delivery in the first quarter and first half of 1913. The market was absolutely open, and consumers were able to contract ahead at comparatively low prices and availed themselves of their advantage. Plants that had long been idle were started up to meet the enormous demand, and the output of iron and steel of all kinds in the last few months of 1912 was at a record breaking pace. Many makers turned down much business on which they were unable to make deliveries.

A great deal of new construction was started in 1912 in the direction of increasing productive capacity in steel ingots. The shortage in steel that prevailed in the last four or five months of 1912 gives assurance that if the heavy present consumption of finished material is maintained, this increase in capacity will be fully taken up. The year 1912 was exceptionally free from failures in the iron trade, and it is believed that in the majority of cases, when the books of the iron and steel companies were closed for 1912, they showed a good margin of profit.

A feature of the trade during the last half of the year was the scarcity of labor, which was being paid the highest wage rate ever known. If the present activity is maintained, this shortage in labor will probably continue and interfere to no little extent with operations.

The Pig Iron Trade

Prices of pig iron in the early part of the year were low, but with the general improved conditions they steadily advanced and in December Bessemer iron was selling at $17.25 at Valley furnace, against $14.25 in January, thus making a gain of $3; basic advanced about $4; No. 2 foundry, from $4.50 to $5 and gray forge about $3. No additions to pig iron capacity were made in the Pittsburgh district in 1912, but work was started on two blast furnaces by the Pittsburgh Steel Company at Monessen, and they are expected to be making iron by June or July this year. The output of pig iron in the Pittsburgh district was considerably increased in the year on account of the four blast furnaces of the Jones & Laughlin Steel Company at Aliquippa being in operation for the greater part of the last half. In the summer and early fall the Carnegie Steel Company, Jones & Laughlin Steel Company, Cambria Steel Company, Republic Iron & Steel Company and Youngstown Sheet & Tube Company were unable to make enough pig iron to meet their needs and were large buyers of both Bessemer and basic at different periods.

The accompanying table gives the average monthly prices in 1912 of Bessemer, basic, No. 2 foundry and gray forge iron, f.o.b. Valley furnace, to which 90c. per ton is to be added for delivery in the Pittsburgh district.

Average Monthly Pig Iron Prices, f.o.b. Valley Furnace in 1912

	Bessemer	Basic	No. 2 foundry	Gray forge
January	$14.15	$12.25	$13.00	$12.50
February	14.00	12.25	13.00	12.50
March	14.19	12.81	13.12	12.56
April	14.25	13.00	13.25	12.75
May	14.23	13.00	13.25	12.92
June	14.25	13.12	13.25	13.00
July	14.30	13.40	13.35	13.05
August	14.56	13.94	13.88	13.38
September	15.47	14.37	14.50	13.94
October	16.90	15.97	16.00	15.37
November	17.11	16.38	16.94	15.78
December	17.25	16.50	17.25	16.25

The Steel Billet Trade

During the year the West Penn Steel Company and the Allegheny Steel Company, both at Brackenridge, Pa., increased their capacity for making open hearth steel, and the Page Woven Wire Fence Company, Monessen, Pa., added a 50-ton furnace. In the early part of the year the four Talbot open hearth furnaces at the Aliquippa works of the Jones & Laughlin Steel Company were put in operation, and are now turning out about 1000 tons of steel per day. The Carnegie Steel Company started work some months ago on the building of fourteen 80-ton open hearth furnaces at Bessemer, Pa., the steel to be used in the rolling of open hearth rails and probably billets and sheet bars. The Youngstown Sheet & Tube Company and the Brier Hill Steel Company, both at Youngstown, Ohio, have new open hearth plants under way, which will be making steel probably in the early summer.

The year opened with the steel market dull, Bessemer and open hearth billets ruling at about $20. No material change in prices occurred until early in May, when the market commenced to advance, owing to the increased demand, and the course of prices thereafter was steadily upward. By the early summer Bessemer and open hearth billets had reached $21.50 to $22, the supply becoming short. When the year closed Bessemer billets were commanding $27 to $27.50 and open hearth billets $28.50 to $29 and very scarce. In the last three or four months of 1912 the National Tube Company, American Sheet & Tin Plate Company and Carnegie Steel Company were very short of steel, being considerably behind on their contracts, and these companies purchased about 150,000 tons of billets and sheet bars, the Carnegie Steel Company making a purchase of 15,000 tons of open hearth billets in late December, for which it paid very close to $29, Pittsburgh. In the early part of the year there appeared to be a surplus of steel making capacity, but with the quickened demand for finished iron and steel this idea was soon dispelled.

The Steel Rail Trade

During 1912 the three Edgar Thomson rail mills of the Carnegie Steel Company were operated more nearly to capacity than in 1911. For some years the Edgar Thomson plant has been handicapped by having no immediate open hearth steel supply, it being the practice of the Carnegie Company to ship cold blooms from its Homestead steel works to the Edgar Thomson plant at Bessemer, where they were reheated and open hearth rails rolled. This is an expensive process, however, and the company's orders for open hearth rails have usually been filled by its Youngstown works. In the summer the United States Steel Corporation made a large appropriation for extensions to the rail mills at Bessemer and also for the building there of an open hearth steel plant. The

No. 2 rail mill is being torn out and a very large mill for rolling standard sections is being installed. When all the improvements under way at Bessemer are finished, which will be in the summer, the Carnegie Company will have a capacity for rolling more rails there than has the Gary works of the Indiana Steel Company.

Prices of standard section steel rails remained at $28 throughout the year, but several advances were made in prices of light rails. The year closed with a very active demand for light rails, the Carnegie Company being sold up for several months. It also had enough contracts on its books for standard sections to keep the Edgar Thomson mills fairly busy for the first six months of this year.

The Structural Material Trade

The year opened with a fair demand for structural shapes, but prices were low, beams and channels up to 15 in. selling at about 1.15c. The structural mills had fairly heavy contracts on their books for delivery through the first half at this price. In January the McClintic-Marshall Construction Company took a contract for 40,500 tons of steel for approaches to the Hell Gate bridge, at New York, this being the largest single contract placed with local interests during the year. By May the demand for structural steel was heavy, and prices commenced to advance. By July 1 beams and channels were strong at 1.25c., and after that date advances came rapidly, with premiums ruling for prompt shipment. The year closing with beams and channels up to 15 in. held at 1.45c. to 1.50c. for shipments beginning far ahead, and the mills sold up for the first half of the year. The enormous increase in the demand for structural shapes could not be met promptly by the mills and when the year closed they were back in deliveries from three to four months, while the Carnegie Steel Company was not taking new orders for delivery to begin before the third quarter. The building of steel barges has become quite an industry in the Pittsburgh district and is consuming a heavy tonnage of steel. The McClintic-Marshall Construction Company, the Fort Pitt Bridge Works and other leading local fabricators, entered the new year with sufficient orders on their books to take their entire output for three or four months ahead.

The Steel Plate Trade

The demand for plates in the first three or four months of the year was only fair, but heavy business came out in May and June, the mills filled their order books, and when the summer months came they were running to the utmost capacity with their output sold ahead for some months. The year opened with prices ruling at 1.10c. to 1.15c., continuing practically unchanged until May. In early July, ¼-in. plates were selling at 1.25c. to 1.30c., and later prices were advanced several times, the year closing with quotations for far future delivery at 1.45c. to 1.50c., and contracts for an enormous tonnage on the books of the mills. In the last three or four months the mills were so congested with business that they were back in deliveries from eight to 10 weeks. In October and November the Carnegie Steel Company sold heavily for delivery all through 1913 on the basis of 1.40c., and it is now practically sold up on plates for the first nine months of this year. There was a famine in the supply of plates and for reasonably prompt shipments they sold as high as 1.75c. to 1.80c. Indications are that the plate mills will be operated to full capacity for the first six months of the year at least.

The Iron and Steel Bar Trade

The year 1912 made a new record in output and shipments of both iron and steel bars. In the latter part of 1911 and early in 1912 the steel bar mills sold very heavily at 1.10c. to 1.15c. for delivery up to July 1, 1912, and in some cases for the entire year. Consumers evidently believed that prices would go no lower, and so freely did they place contracts that in May and June the bar mills were pretty well sold up for the remainder of the year. There was a steady advance in prices from this time, and the year closed with the leading makers of steel bars quoting 1.40c. to 1.45c. for future delivery, and with very heavy contracts on their books for delivery in first half of 1913. One leading maker has taken heavy contracts for shipment all through this year on the basis of 1.40c., Pittsburgh.

There was a famine in supply of steel bars in the last three or four months of the year, and premiums of $3 to $6 a ton were paid for reasonably prompt deliveries. It is said that in special cases steel bars sold from 1.75c. to 2c., but the greater part of the contracts on the books of the mills are at 1.40c. to 1.45c. Prices on iron bars also improved, and the high figures ruling resulted in the starting up of a number of bar iron mills that had been idle for four or five years. The year closed with iron bars ruling at 1.65c. to 1.70c. for future delivery, and the mills sold up for several months.

The Sheet Trade

The year 1912 was one of the best in point of tonnage the sheet trade has ever known. Prices in the last half of the year were such as to allow a good margin of profit. When the year opened, No. 28 black sheets were selling at 1.85c. to 1.90c., and very heavy contracts were taken at these prices for delivery through the first quarter and first half of 1912. In May the demand expanded rapidly, and prices improved. When August and September were reached the sheet mills were having an enormous demand and prices were steadily advancing. In the fall the leading mills were sold up for three or four months ahead and were back in deliveries from eight to 10 weeks. The year closed with No. 9 blue annealed sheets ruling firm at 1.65c. No. 28 black, 2.25c., and No. 28 galvanized, 3.40c. Premiums of $1 to $2 a ton over these prices were readily paid by consumers to mills that could make reasonably prompt shipments. The year closed with the leading mills having contracts on their books for most of their output for the first quarter and a good deal of tonnage sold for delivery in the second quarter of 1913.

The Tin Plate Trade

No notable additions to tin plate producing capacity were made during the year by local mills, but the Jones & Laughlin Steel Company operated its second unit of 12 mills at Aliquippa, four of these having been started in December, 1911, and the other eight in January and February following. The year opened with tin plate ruling at $3.40 per base box for 14 x 20 100-lb. coke plates, but this price was not being strictly observed, and some contracts were booked as low as $3.25. There was not much improvement in prices until July. The year closed with 100 lb. coke plates firm at $3.60. The American Sheet & Tin Plate Company and other leading tin plate makers broke records for output several times in 1912. In October and November very heavy contracts from can makers and meat packers were entered by the mills for delivery in the first and second quarters of this year. It is stated that the greater part of the tonnage in these contracts was taken at the full price of $3.60 per base box, the usual differential of about 10c. having been allowed to the very large consumers.

The Merchant Pipe Trade

As in the case with nearly all other lines of finished iron and steel, records for output and shipments of pipe were broken in 1912. In point of tonnage the year was the best the pipe trade has ever known, while prices in the last half of the year were very satisfactory to the makers. Some heavy contracts for gas and oil lines were placed during the year, one of these being a Roumanian order for about 35,000 tons taken by the National Tube Company in early December. An important occurrence was the announcement by the National Tube Company in early November of its intention to change pipe weights and lists on January 1. For years it had been the custom of steel pipe mills to sell pipe on merchant weight and card weight, and this allowed mills that were disposed to do so to roll light weight pipe. The action of the National Tube Company in basing its lists on full weight was followed by all the other leading iron and steel pipe mills; effective from January 1, iron and steel pipe and iron and steel boiler tubes will be sold at full weight, the usual differential of 5 per cent. either way still being allowed. Several iron and steel pipe mills report that their output and shipments in 1912 showed an increase of 25 to 50 per cent. over 1911.

The Iron and Steel Scrap Trade

The scrap trade in the first half of the year was unsatisfactory, prices ruling low, with the demand dull.

With the increased demand for finished iron and steel, scrap became more active, and in September, October and November trade was very heavy, prices showing considerable advances. In December the demand quieted down, and prices declined from 50c. to $1 a ton. The year closed with the market dull and prices weak. We give herewith a table showing the average monthly prices of heavy steel scrap, No. 1 foundry cast, bundled sheet scrap, rerolling rails, cast iron borings and machine shop turnings during 1911.

Average Prices of Old Material, Per Gross Ton, Pittsburgh, in 1912

	Heavy steel scrap	No. 1 foundry cast	Bundled sheet scrap	Rerolling rails	Cast iron borings	Machine shop turnings
January	$12.75	$12.20	$10.65	$12.50	$9.57	$9.75
February	12.12	12.37	10.69	12.64	9.32	9.50
March	12.62	12.37	11.00	12.37	9.19	9.69
April	13.06	12.75	11.25	13.25	9.62	9.87
May	13.25	12.75	11.25	13.50	9.73	10.00
June	13.44	12.81	11.81	13.81	9.94	10.62
July	13.34	13.00	11.81	14.25	9.62	10.25
August	13.55	13.05	12.10	14.90	9.65	10.20
September	14.11	13.31	12.44	15.00	9.87	10.77
October	15.85	14.30	13.10	16.50	10.15	11.29
November	15.12	14.81	12.87	16.44	10.05	10.69
December	14.75	14.50	12.75	16.25	9.90	10.50

The Coke Trade

The year opened with a scarcity existing for furnace coke for prompt shipment, for which delivery it was bringing as high as $1.85 to $1.90 per net ton at oven, while contracts for first were ruling at about $1.65. Standard 72-hour foundry coke for prompt shipment was quoted at $2 and on contracts for first half at $2.15 at oven. The output of Connellsville coke at this time was running about 350,000 tons per week. There was no material change in the situation as regards output and prices for some months. During the summer, with the great activity in the iron trade bringing in a number of idle blast furnaces, the demand for furnace coke increased sharply, and prices advanced. In the last three months of the year there was a great scarcity of furnace and foundry coke for prompt shipment, spot furnace coke selling as high as $4 to $4.10 per net ton at oven, and 72-hour foundry at $4.50 to $4.75. Heavy contracts for furnace coke were placed in November at as high as $3.25 at oven, but a good many consumers had covered their requirements for the first half prior to this at $2.25 to $2.50 at oven. We give herewith a table showing the average monthly prices per net ton at oven of prompt and contract furnace and foundry coke during 1912:

Average Monthly Prices, Per Net Ton at Oven, of Connellsville Coke in 1912

	Prompt furnace coke	Contract furnace coke	Prompt foundry coke	Contract foundry coke
January	$1.82	$1.70	$1.97½	$2.13
February	1.78	1.80	2.09	2.20
March	2.12½	2.12	2.56	2.44
April	2.39	2.22	2.69	2.60
May	2.28	2.39	2.58	2.47
June	2.02	2.30	2.40	2.50
July	2.21	2.25	2.40	2.50
August	2.21	2.25	2.40	2.50
September	2.37½	2.35	2.54	2.62
October	3.41	2.67	3.65	3.25
November	3.94	3.12	4.25	3.75
December	4.00	3.25	4.50	3.87

The Outlook

The iron trade has entered the year 1913 under very favorable conditions, the leading producers having their output sold ahead for some months. The consumption is at an enormous rate, but owing to the influence of the leading makers, contract prices have been kept at a level that is regarded fair to the maker and to the consumer. While 1912 was a Presidential election year, that did not seem to cut much of a figure in business, which went steadily ahead, but the announcement by President-elect Wilson that he will call an extra session of Congress early in the spring caused some uneasiness and perhaps resulted in a slight falling off in specifications and in the volume of new business in the last month of 1912. On the whole, the outlook for 1913 is good, and it is believed that the first half of the year will be fully as active in every way as was the second half of the year just closed.

The Philadelphia Iron Trade in 1912

BY A. A. MILLER

Comparative dullness at the opening and unprecedented activity at the close marked extremes in the iron and steel trade in 1912. Early in the year the market favored the buyer, toward mid year conditions favored the seller, and the year closed a strong sellers' market. During the first quarter furnaces and mills operated on a restricted basis, increasing materially in the second quarter, while in the second half they ran to capacity. Mid year brought wage advances in many lines, but in the summer and fall months common labor was at a premium and played an important part in the restriction of output. A threatened anthracite coal strike in the spring caused some hesitancy, but it was adjusted without great delay.

The open policy of marketing iron and steel products resulted in irregularity of prices in all lines. In the first quarter weakness was apparent, due to unsettled conditions continuing from 1911. After the first quarter a steady general upward movement set in not governed by any understanding among makers but based on demand, selling policy and the condition of their order books.

Finished material makers operated at 65 to 75 per cent. basis in the first quarter; by mid year full capacity had been reached, and at the close many were sold up for first quarter and some for the first half of 1913. Eastern mills did not follow the policy of selling heavily for extended delivery in the second half, but booked orders conservatively, profiting by steadily advancing prices and sharp premiums for prompt deliveries.

Shipbuilders have not been so busy in years. Activity began early with the placing of a number of orders for vessels to enter the Panama Canal trade. Ship yards have enough business to insure operations to comparatively full capacity for the next two years.

Throughout the year stocks of crude and finished materials with both producers and consumers have been small. The usual conservative policy attending a Presidential year had some bearing on this, although as the year advanced, and the demand for material became so great, the customary hesitancy on this account was a minor factor.

Iron Ore

Large quantities of ore were carried over from 1911. This, together with price uncertainties, caused hesitancy early in the year. In March the open market policy brought about readjustments. Heavier aggregate sales of Lake ores were made in the East in 1912. Importations at this port show a new record, the total reaching approximately 1,300,000 tons, subdivided principally as follows: Cuban, 596,311; Swedish, 330,000; Newfoundland, 180,000; Spanish, 95,300; New Brunswick, 70,000, and Venezuela, 12,100. Heavy purchases of Swedish ore abroad have practically removed that ore from this market, except that coming to buyers under long contract. Prohibitive freights and scarcity of bottoms have restricted imports of Mediterranean ores. Imataca ore from Venezuela was a newcomer in the market this year. Heavy purchases were made late in the year for 1913 delivery at advances ranging from 25c. to 65c. a ton over those ruling on this year's contracts.

Pig Iron

Early in the year the market favored the buyer, while during the latter half producers controlled the situation. At the beginning of 1912 statistics compiled by the Eastern Pig Iron Association showed a minimum volume of unfilled orders, together with the highest stocks, with 18 out of 46 furnaces active. During the first half orders exceeded the current make and stocks gradually declined. In the last quarter unfilled orders showed an increase of approximately 62 per cent. over that early in the year, while stocks showed almost the exact reverse, being 62

per cent. lower in November than in the first quarter, representing at the close of the year about half of what might be considered normal. In December 27 out of 45 furnaces were active.

Statistics compiled by the Virginia Pig Iron Association show stocks at their highest in the beginning of the year. A minimum of unfilled orders was recorded in the first quarter. The upward movement of orders began in May, the decline in stocks setting in at the same time. In the closing months of 1912 unfilled orders were nearly two and three-quarters times the amount on hand early in the year, while stocks were approximately 40 per cent. below the January total. The leading interest reduced its stocks from 170,000 to 121,000 tons in the 12 months, the latter accumulation representing practically 95 per cent. of the total stocks on Virginia furnace yards. Out of 21 Virginia furnaces 6 were active at the opening and the same number at the close of 1912.

Course of Prices

The year opened with prices weak. In April a steady advance set in. The full gain, from the opening to the close of the year was $3 a ton in Pennsylvania No. 2 X, $3.14 in Virginia No. 2 X, $3.50 in standard gray forge, $4 in basic, and $5.25 in standard analysis low phosphorus. Low grade iron for pipe making advanced from $14.25 to $17.75, delivered in Delaware River yards in the 12 months. Buying was largely in cycles, subsiding after each advance, until it was seen that the new basis had been firmly established. Higher coke, ore and labor costs restricted the movement toward blowing in idle furnaces to some extent. Southern iron has not been an important factor in this market, owing to its relatively higher price delivered here. Prices of Pennsylvania and Virginia brands were on a comparatively even basis early in the year. In April the usual differential in favor of Virginia iron again became effective and was maintained throughout the year. Forge iron for rolling mill purposes was irregular, although sales to cast iron pipe makers were heavy. Buying in steel making grades was spotty. Basic has become a less important factor as, with a few exceptions, steel makers in this district now control their own blast furnaces. Standard low phosphorus has been in relatively good demand, and in the closing months of the year large sales for extended delivery were made.

The accompanying table shows the average range of minimum quotations by months for the principal grades of pig iron, delivered in buyers' yards, eastern Pennsylvania and nearby points:

Average Prices of Pig Iron Delivered in Buyers' Yards, Eastern Pennsylvania and Nearby Points in 1912.

	Penna. No. 2 X	Virginia No. 2 X	Standard gray forge	Basic	Standard low phos.
January	$14.85	$15.00	$14.25	$14.25	$19.19
February	14.85	15.00	14.25	14.25	19.00
March	14.92	15.15	14.25	14.37	19.00
April	15.00	15.66	14.43	14.87	19.44
May	15.22	15.78	14.50	15.15	19.55
June	15.31	15.80	14.56	15.25	19.75
July	15.69	15.91	14.94	15.50	20.00
August	15.85	16.45	15.35	15.95	20.60
September	16.59	17.05	15.87	16.25	21.50
October	17.60	18.09	16.90	17.43	22.60
November	18.31	18.80	17.62	18.12	23.75
December	18.50	18.80	17.75	18.25	24.25

Billets

Until May Eastern billets were in line with prices quoted by Western producers. During the remainder of the year Eastern mills based their prices on the supply and demand. Sales were made conservatively. Western producers, heavily sold ahead, became active buyers in the Eastern market. Basic open-hearth rolling billets sold at $22.40, delivered during the first quarter. Midsummer found billets scarce and prices moved up to $24.40. In August and September premiums of several dollars a ton were paid for prompt shipments. Prices steadily advanced until at the close of the year $32, delivered, was paid for first quarter deliveries, and prompt shipments were practically unobtainable. The export demand for rolling billets during the last of 1912 was particularly heavy, although but a small volume of business was taken by Eastern makers.

Plates and Structural Material

Operations at the opening of the year were at about 60 per cent. of capacity; in February at 65 per cent., in April 75 to 80 per cent., and in May 90 to 95 per cent. June found mills operating at normal capacity, although production was somewhat restricted by labor shortage. In the second half, record productions were frequently made. From July the mills were so well sold up that premiums ranging from $1 to $4 a ton were paid for prompt delivery. Consumers unable to get shipments in the West became active buyers in the East. Toward the close of the year it was practically impossible to get prompt shipments on either plates or shapes, except from warehouse, and mills were sold up to their capacity from three to six months ahead.

Eastern mills in few cases made quotations as low as Western mills at any time in the year. From 1.30c. to 1.40c., delivered ruled for plates and plain shapes early in the year with plates slightly harder than shapes. In May plates ranged from 1.35c. to 1.40c., with shapes at 1.30c. to 1.35c. In July Western plates could be had for uncertain delivery at 1.40c., delivered, although Eastern material for reasonably early shipment commanded 1.45c. to 1.50c. Structural material also became scarce and commanded premiums. In August Eastern plate mills established a $1 differential between sheared and universal plates. Prices advanced steadily under a constant pressure of business. In October both plates and shapes ranged from 1.75c. to 1.80c. for early shipment, although on uncertain forward business 1.60c. was being quoted by Western mills. In December considerable business for first quarter shipment was placed with Eastern mills at 1.75c., delivered. Large inquiries for export were before the trade from time to time, principally in connection with material for building ships.

Sheets

Sheet mills in the East operated at practically full capacity during 1912. In the first half activity was largely maintained by miscellaneous business. Western No. 28 gauge sheets at the opening of the year were quoted at 2.05c., delivered here, but declined to 1.95c. in the first quarter. Eastern makers, however, did not reduce prices to conform with Western mills. In April the general demand improved and prices began a steady but slow upward movement reaching 2.05c. in June and 2.20c. in August. A sharp scarcity developed in September, with premiums prevailing for prompt shipments. Prices advanced to 2.25c. in September, and to 2.40c. in October, at which they remained until the close of the year. Eastern mills entered heavy orders during the closing months for the first quarter of 1913. Heavy premium business came to Eastern mills in the last half, $4 to $6 a ton over regular prices being freely paid for prompt shipments. Eastern mills making smooth, loose-rolled sheets maintained a general advance of ¼c. to ½c. per lb. over prices quoted above, which are for Western sheets, delivered in this district.

Iron and Steel Bars

Bar mills operated on an irregular basis during the first half of the year, becoming more active in the third quarter. In the last quarter they were extremely busy, and a number of long-idle rolling mills became active. Iron bars in January were quoted at 1.27½c., delivered, declining in February to 1.22½c., advancing in April to 1.30c. and in May to 1.35c. In June business was lighter and prices declined to 1.30c.; recovery was almost immediate, and in August 1.37½c. was quoted, reaching 1.47c. in September. Prompt bars then became scarce and the upward movement was rapid—to 1.55c., 1.60c. and 1.67½c. During November and December ordinary iron bars for forward delivery were firm at 1.67½c., but prompt bars commanded from 1.75c. to 2c., delivered.

Early in the year business in steel bars was quiet at 1.30c., delivered here, heavy contracts having been entered at previous low prices. Quotations receded to 1.25c. in March but advanced to 1.30c. in April. Heavy contracting usually preceded each advance. In June 1.35c. and in August 1.45c. were named. In September prompt steel bars commanded 1.75c., although contracts were taken at 1.45c. to 1.50c. During the last quarter prompt steel bars brought 1.85c., with contract bars at 1.55c. to 1.60c., delivered.

Old Material

Irregularity both in demand and prices characterized the year. Supply and demand had more bearing on the

market than speculative transactions. The financial embarrassment of E. Dreifus & Co. in April caused considerable confusion in the market for a short time, particularly in heavy melting steel.

The demand at the opening of the year was inactive and prices gradually declined, the whole list being at the low point during the first quarter. Beginning in April, increasing activity at mills brought out a greater demand and prices steadily advanced although the market held well within bounds, as the supply of old material increased as the productive rate of mills made gains. Bargain lot buying was a feature in nearly all grades, and only occasionally did consumers come into the market for definite large blocks. Frequently consumers bought direct from railroad lists, paying higher prices than offered by merchants. The demand for rolling mill grades fluctuated with the rate of mill operations. At the close of the year a sharp demand for old car wheels for export, particularly to Canada, advanced prices sharply. In December there was a gradual recession of prices in all grades, owing to a lighter demand.

The range of quotations, showing the monthly average minimum price for the leading grades, delivered in buyers' yards in this territory, taking a freight rate varying from 35c. to $1.35 per gross ton from Philadelphia, is given in the accompanying table the average minimum price, as well as that for 1911, being shown in the closing columns:

Average Prices of Old Material, Delivered in Buyers' Yards, Eastern Pennsylvania, in 1912, Per Gross Ton

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average 1912	Average 1911
No. 1 heavy melting steel scrap.	$12.19	$11.70	$11.80	$12.94	$13.50	$13.50	$13.50	$13.65	$14.50	$15.10	$15.50	$15.25	$13.59	$12.82
Low phosphorus heavy melting steel scrap	15.50	15.50	15.31	15.62	16.25	16.25	16.31	17.35	17.75	18.20	19.25	18.92	16.85	16.92
Old iron rails	16.37	15.80	15.50	15.87	16.50	16.50	16.50	16.50	16.87	17.60	18.75	18.17	16.58	16.98
Old car wheels	12.37	12.00	11.94	12.87	13.90	14.00	14.00	14.05	14.25	14.87	15.00	15.50	13.73	12.80
No. 1 railroad wrought	15.37	14.00	14.12	15.44	15.75	15.44	15.50	15.80	16.31	16.80	17.06	16.25	15.57	15.54
Wrought iron pipe	11.94	11.50	12.69	12.12	12.50	12.50	12.50	12.80	13.19	13.75	14.00	13.50	12.75	12.41
Wrought turnings	9.25	9.00	8.80	9.69	10.40	10.31	10.50	10.65	10.94	11.40	11.50	11.00	10.27	8.68
Cast borings	8.31	8.00	8.50	9.37	9.60	9.50	9.56	9.75	10.06	10.85	11.37	10.83	9.64	8.14
Machinery cast	13.42	13.00	13.12	13.62	13.75	13.75	13.75	13.75	13.96	14.50	14.75	15.00	13.84	13.25
Railroad malleable	11.75	11.75	11.75	11.75	12.00	12.00	12.00	12.10	12.50	12.90	13.37	13.50	12.28	11.65
Stove plate	10.06	9.50	9.62	10.14	10.50	10.50	10.50	10.50	10.81	11.15	11.50	11.50	10.36	10.05

The Chicago Iron Trade of 1912

BY O. J. ABELL

The review of the iron and steel trade in 1912 in every section of the country must be a narrative of new precedents in railroad and industrial financing. It must record subsequent buying of iron and steel in quantities that included nearly 5,000,000 tons of rails and an aggregate of 250,000 cars requiring over 2,500,000 tons of materials. It will reach its closing chapter with the stream of orders still running millward at almost full tide although the order books of some of the mills are already filled for a full year ahead. To the Chicago market each of these particulars is particularly applicable, for continuously this market has been in the forefront of developments and has created for itself thereby a new importance in the country-wide survey of trade.

Western Financing and Purchasing Power

For the first time the banks of Chicago passed the billion-dollar deposit mark. Correspondingly they became a larger factor in the Western financing that included an issue of $15,000,000 in bonds by the Chicago & Northwestern Railway, $30,000,000 in notes of the New York Central Lines, $20,000,000 in bonds by the Rock Island System, $35,000,000 by the Chicago, Milwaukee & St. Paul, and $8,000,000 by the Wabash receivers. Industrial flotations to which Chicago contributed largely included the International Harvester Company's sale of $20,000,000 in bonds, the M. Rumely Company and the Emerson-Brantingham mergers and the new financing of Pettibone, Mulliken & Co. These were representative issues of new securities that in the aggregate reached amazing totals and made possible the tremendous purchasing power which, first appearing in November, 1911, is still unspent.

In 1911 railroad buying of steel in this territory amounted to approximately 15 per cent. of the total tonnage. In 1912 the railroads bought in the form of rails, track fasteners, cars and bridges, nearly 80 per cent. of all the orders placed with Western mills. From domestic and Canadian railroads alike record-breaking tonnages were booked, and to this buying the unusual operations of the year are due. The positive need of new equipment and the inclination to buy were supported by favorable crops. The makers of agricultural implements were thus called upon for a large production, and, as business begets business, so as the year progressed the larger activity ramified through all the branches of iron and steel manufacture.

General Conditions in the Steel Trade

At the beginning of the year the mills both in the West and East, particularly the latter, were still exceedingly hungry for orders. Not only was the first tonnage to materialize tributary to the mills of this territory, but Chicago quotations were still being made independently of the Pittsburgh basis, and by the end of February Western mills were several weeks behind in their shipments while the mills of Eastern territory were still able to promise immediate delivery. As a result the first tendencies toward an improvement in prices developed here. They were held in check, however, by the willingness of Eastern producers to take business at prices sufficiently low to obtain the orders. At that time local quotations were just meeting competition.

It was not until the end of the first quarter, after three months of record-breaking tonnage, largely for new cars, that the first definite advances in price became effective, and throughout the first half the orders taken were on a price basis in which there was little or no profit. Until the end of March, plates and structural shapes were sold nominally at 1.28c., Chicago, and in numerous instances there is little reason for doubting that even lower prices were made. Steel bars could be had in plenty at 1.25c., various reports current at that time citing quotations as low as 1.20c. and lower. The steady advance since that time until the present stable price level was reached covered a range of $7 a ton for shapes and plates and about $6.50 for steel bars. A concrete example of what the low prices prevailing in the early part of the year saved for the user of steel may be obtained from the new Continental and Commercial National Bank Building, for which the steel is now being erected. This building will require 12,000 tons of steel, which is to-day worth nearly $100,000 more than its purchase price, and fabricated is more valuable by $150,000.

Rail Buying

It was not until after the first half of the year that the railroads began to buy heavily of rails. Until February 26 the rail mills at South Chicago and at Gary were down, and for three or four months after they were started they ran at much less than capacity. The preponderance of open-hearth rails specified speedily engaged the full capacity of the Gary mill, and in this particular department the order books of the Steel Corporation are probably

filled through a longer future period than in any other, either East or West. At the Illinois Steel Company's South works, where Bessemer rails are rolled, promises of delivery within six months can still be made.

In the past year a much larger tonnage of Western rails has been awarded to some of the Eastern mills, in part because of better deliveries obtainable and also because of unusually excellent service records previously made. This has been noteworthy in view of the premium imposed upon these rails by the additional freight to be paid. A number of small orders of an experimental nature were also placed for Mayari Bessemer and alloy Bessemer rails. The Chicago, Milwaukee & St. Paul purchased a small tonnage in which specification of 0.6 per cent. of copper was included, and the Illinois Steel Company placed in service a number of lots of rails rolled from electric steel.

Much of the delay in placing rail orders at the beginning of the year was occasioned by the slow settlement of rail specifications. To a greater extent than ever before these specifications called for open-hearth steel, and to these specifications the railroads generally adhered despite the most discouraging promises of delivery.

The Bar Trade

The Western bar market has offered an interesting contrast of conditions as they have affected iron and steel bars. In the latter part of 1911 steel bars were so cheap that they replaced bar iron. In the first part of this year the demand for steel bars increased much more rapidly than for iron, and as late as April bar iron quotations were $3 a ton below steel. Deliveries of steel bars then steadily grew worse, and this fact, coupled with the generally broadening demand, greatly improved the position of the bar iron mills, so that by August the spread was only about $1.50. At the present time bar iron prices are on a par with steel at Chicago, and the promptness with which deliveries can be made has exactly reversed the condition of a year ago, iron bars having been bought in numerous instances as a substitute for steel.

The market situation in steel bars brought to the surface the first evidence of genuine confidence in the permanence of prosperous conditions. The lean years that preceded 1912 had developed a preponderance of pessimism. The rate at which the railroads had bought equipment in the last quarter of 1911 exhausted the anticipations of the average man, and the heavy tonnages of January, February and March failed to dissipate the skeptical expectancy of an early cessation of buying. In April, however, implement manufacturers, with their first-hand knowledge of the crops, began to negotiate for the following year's requirements of bars, and early in the second quarter most of the contracting had been completed on the basis of 1.15c., Pittsburgh. Chicago had again shown itself the barometer of trade.

The Pig Iron Trade

While the production of steel making iron has brought the total production of pig iron up to record-breaking proportions, melters of merchant iron did not begin to enjoy increased business to any great extent until the second half of the year. The building of cars into which malleable and steel castings entered largely began to result in purchases of malleable Bessemer and basic iron from local furnaces, but among the local furnaces there were not only accumulated stocks of considerable size to be absorbed, but a large proportion of the idle furnace capacity. One stack at Mayville, one at Bay View, the Thomas furnace, one Federal furnace and the two new Iroquois furnaces were idle at the beginning of the year. Competition for the business offering, which included furnaces in Ohio and Michigan, was therefore very keen and prices remained at the level of $14 to $14.50 for No. 2 foundry until July.

In the meantime the Southern furnaces, which were selling No. 2 foundry in this market on the basis of $10, Birmingham, and at times as low as $9.75, had strengthened their position by large sales to pipe makers and for export. The price of Southern iron gradually advanced until in June it was held at $1.25 above local iron in Chicago. The general market was accordingly benefited, and although all of the above idle furnaces were blown in—Thomas furnace being subsequently blown out—the demand for iron was such as to bring steady advances in both Northern and Southern iron. The price level at the end of the year is now $4 above that in January last.

Comparison of Prices

The following tables show the course of prices in the Chicago market, compiled from the weekly reports in *The Iron Age:*

Average Chicago Prices of Pig Iron, 1912

	Northern coke No. 2	Lake Superior charcoal	Southern coke No. 2
January	$14.00	$16.00	$14.35
February	14.00	15.95	14.65
March	14.00	15.75	14.85
April	14.25	15.75	14.98
May	14.50	15.75	15.35
June	14.50	16.25	15.54
July	14.63	16.25	15.73
August	15.30	16.25	16.35
September	15.75	17.25	16.85
October	17.00	18.55	18.05
November	17.88	18.75	18.35
December	18.00	18.75	18.35
Average for year	$15.32	$16.77	$16.11
Average for 1911	$14.87	$16.96	$14.80
Average for 1910	17.10	18.67	16.30
Average for 1909	17.49	19.50	17.30
Average for 1908	17.57	20.24	16.76
Average for 1907	24.50	26.56	24.47
Average for 1906	20.43	20.72	19.44
Average for 1905	17.65	17.99	16.66
Average for 1904	14.37	15.50	13.92
Average for 1903	19.25	22.13	18.31
Average for 1902	20.86	23.50	20.10
Average for 1901	15.38	17.50	14.60
Average for 1900	19.47	22.00	18.35

Average Chicago Base Prices of Finished Iron and Steel, 1912

	Common bar iron. Cents	Soft steel bars. Cents	Structural steel. Cents
January	1.15	1.25	1.30
February	1.15	1.25	1.28
March	1.15	1.25	1.28
April	1.15	1.32	1.37
May	1.22	1.38	1.43
June	1.27	1.38	1.43
July	1.31	1.43	1.48
August	1.40	1.48	1.53
September	1.45	1.53	1.58
October	1.50	1.58	1.62
November	1.54	1.58	1.63
December	1.56	1.58	1.63
Average for year	1.32	1.42	1.46
Average for 1911	1.22	1.47	1.50
Average for 1910	1.45	1.62	1.66
Average for 1909	1.43	1.50	1.59
Average for 1908	1.56	1.66	1.82
Average for 1907	1.78	1.77	1.87
Average for 1906	1.71	1.68	1.86
Average for 1905	1.65	1.65	1.78
Average for 1904	1.41	1.50	1.71
Average for 1903	1.65	1.72	1.75
Average for 1902	1.71	1.73	1.75
Average for 1901	1.58	1.58	1.70
Average for 1900	1.75	1.75	2.00

Average Chicago Prices for Old Material, 1912

	Old iron rails. Gross ton	No. 1 railroad wrought. Net ton	Heavy cast scrap. Net ton	Heavy melting steel scrap. Gross ton	Old steel rails, rerolling. Gross ton
January	$15.19	$11.63	$11.25	$10.75	$13.00
February	15.25	11.30	11.25	10.75	12.80
March	15.31	11.44	11.31	10.94	12.75
April	15.56	12.31	12.06	11.56	12.88
May	16.25	12.75	12.20	12.05	13.50
June	16.25	12.57	11.81	12.12	13.50
July	16.25	12.06	11.75	11.69	13.50
August	16.30	12.50	12.15	12.25	14.00
September	16.88	13.13	12.81	12.81	15.00
October	17.95	14.25	14.20	13.95	16.30
November	18.25	13.50	13.50	13.69	16.50
December	17.68	13.06	13.25	12.88	16.50
Average for year	$16.43	$12.54	$12.29	$12.12	$14.19
Average for 1911.	14.67	11.23	11.08	10.92	12.91
Average for 1910.	17.34	12.99	13.32	13.43	16.34
Average for 1909.	18.31	13.76	13.79	14.45	15.82
Average for 1908.	16.60	12.45	12.69	12.45	....
Average for 1907.	22.47	14.63	17.26	15.08	....
Average for 1906.	23.04	15.62	14.55	14.74	....
Average for 1905.	20.18	16.14	13.50	13.97	....
Average for 1904.	16.56	12.45	10.95	10.72	....
Average for 1903.	20.29	16.07	14.75	15.50	....
Average for 1902.	23.91	19.68	15.03	17.37	....
Average for 1901.	19.50	15.00	11.25	....	....
Average for 1900.	17.90	15.00	11.00	....	....

New Plant Construction

The year has been one of maximum operation of existing capacity rather than a year of new construction in this territory. With the exception of the Iroquois furnaces, which could have been placed in operation last year had conditions warranted, no new blast furnace capacity has been added.

The Inland Steel Company is adding four 60-ton open-hearth furnaces and the Illinois Steel Company is adding two at its South works and completing a battery at Gary. A new slabbing mill has also been added at Gary. Other improvements have been made in connection with auxiliary equipment.

For the production of merchant by-product coke, the By-Product Coke Corporation has built a battery of 70 Solvay ovens at South Chicago and the Coal Products Mfg. Company a battery of 35 Koppers ovens at Joliet.

The record of new construction would be incomplete without mention of the extensive re-equipment made necessary at the end of the year by the decision of the Standard Oil Company of Indiana to sell no more fuel oil. Both steel mills and steel foundries in this territory were large users of fuel oil for operating open-hearth furnaces. The changing over to another fuel became an immediate necessity, and large expenditures have been required for the installation of gas producers, regenerative chambers and auxiliary equipment.

The year 1912 has established new standards of production and it closes with market quotations on a satisfactory level. The average profits throughout the year were greatly reduced by the prices of the first half, during which contracts were placed on which material is still being delivered. It will remain for 1913 to return to the mill and blast furnace owner the full reward for his labors and the risk of his capital.

The Cincinnati Iron Trade in 1912

BY CHARLES L. SMITH

Somewhat contrary to the usual rule, considerable business was transacted in January, 1912, and one leading firm's reports show a larger tonnage booked than for any similar period of its existence. More interest was taken in Southern iron, as it was approximately $1 a ton cheaper than Northern iron for users in this immediate vicinity. This buying movement extended well along into February, but was checked the first week in March and did not commence again until southern Ohio producers opened their books for third quarter business in the latter part of that month. Prices were marked up slightly in both districts.

Heavy Buying of Basic Iron in April

The distinguishing feature of April was the very large demand for basic, and nearby mills took over 50,000 tons for shipment over the remainder of the year. Foundry iron was also in better demand, although, with the exception of pipe-making iron, no large contracts were consummated. Advances in both Southern and Northern were noted, with Southern producers probably a little firmer in their demands for a minimum of $11 at furnace.

While business was dull in May, Southern iron continued to show signs of increasing strength, in the face of diminishing stocks. Southern charcoal was reported more active, and a small advance was made in market quotations. In the Hanging Rock district a large quantity of resale iron was offered, and prices did not advance as anticipated by the majority of the trade. In fact, there was a slump in the latter part of the month, while Southern foundry iron was marked up about 25c. a ton. A number of sales of Jackson County silvery iron were made, and the month closed with several smaller deals still under negotiation.

During June the market simply marked time, and no transactions of note were reported. However, Southern foundry iron continued to gain strength, and there was a fair demand for the lower grades. Authentic reports as to a reduction in furnace stocks helped out the situation, and the average quotations in the two producing centers tributary to this market showed some improvement. A fair quantity of malleable was taken by different manufacturers in this territory.

A deadlock between the coke and pig iron producers on prices prevailed in July, and this, together with reports of fast decreasing iron stocks, had a tendency to strengthen still further the prevailing quotations. In the Ironton district, furnace interests were holding out firmly for $13.50 at furnace. Resale iron, for prompt shipment, was obtainable about 50c. a ton below this price. The majority of Southern furnace operators advanced the price to $11.50, Birmingham basis, and most of them adhered to this figure.

Strong Buying Movement in August

Buying for last quarter shipment was particularly strong in August, and several local dealers opened their books for delivery in the first quarter of 1913. A generally optimistic feeling was shared by both buyer and seller, but for the first time in months the latter held the whip hand. The rapidly increasing consumption of both foundry and steel-making irons, with the natural decrease in stocks, enabled producers to stiffen prices further, and the average Cincinnati quotation for both Southern and Northern No. 2 foundry was around $15, representing a net furnace quotation of about $12, Birmingham, and $14, Ironton.

Although prices continued to advance in September, there were continued heavy bookings for last half and first quarter delivery, and there was also some buying for first half shipment in 1913. With order books comfortably filled, the wind-up of September brought out an additional advance in prices, and a number of Southern producers were not willing to accept anything below $13, Birmingham, and a uniform price of $15.50, Ironton, was established on Northern No. 2 foundry. Both of these prices were subjected to cuts on the part of holders of resale iron, and in the Southern territory the Tennessee furnaces did not fall into line until the latter part of the month.

At the beginning of October it was brought out more forcibly that both basic and malleable were scarcer; foundry iron, for prompt shipment, was also harder to obtain. The high price of coke compelled Northern producers to make advances that brought up the monthly average on foundry iron to $15.90, Ironton, for No. 2 foundry, but the Southern furnaces did not follow very closely.

In November, Southern furnaces took advantage of the difference in quotations prevailing and considerable small business was booked from the jobbing and stove foundry interests. Prompt shipment No. 2 foundry iron was quoted firm by a number of furnaces at $17, Ironton, although these same producers were willing to book future business at the same figure. A few tentative inquiries were put out for basic, but no sales resulted. Foundry iron was chiefly bought under cover and at the direct solicitation of salesmen. This same condition prevailed throughout December, but at the wind-up of the month there was probably more interest taken in the market on the part of consumers than for any previous similar period.

Invoice Prices of Southern Iron

Through the courtesy of a leading iron merchant, we are enabled to give below the average invoice price of Southern No. 2 foundry iron for the following months:

January	$10.35	May	$10.30	September	$11.00
February	10.35	June	10.45	October	11.20
March	10.38	July	10.60	November	11.40
April	10.40	August	10.97		

The above figures are f.o.b. cars at furnace, Birmingham basis, and would indicate that there was considerable quiet buying for future shipment during the first part of the year when prices were very low.

The Coke and Scrap Trades

The coke supply question has become a very vexing one for quite a number of furnace interests. Since August steadily advancing prices have prevailed, while more than one furnace in the Hanging Rock district has been compelled to bank temporarily, due to a short supply of fuel. Excellent weather conditions enabled the transportation lines to make fairly good deliveries the latter part of the year, or the situation would have been more serious than it was.

A local coke dealer, who has followed the situation closely, predicts a continued famine through the winter. The scarcity of labor and cars, as well as the increased consumption of 48-hr. coke, in which the so-called domestic coke now plays no small part, will keep all the present producers at their wits' end to supply old customers.

Owners of a number of idle beehive ovens cannot see their way clear to go to the large expense necessary for remodeling them, and at the present time there is no relief in sight for the coke consumer.

Scrap material advanced quite steadily during the entire year, with only a few recessions. The railroads unloaded large quantities in July and August, and local yards are fairly well stocked.

The accompanying table shows the course of prices throughout the year on leading grades of pig iron and scrap, averaged from our weekly quotations:

Prices of Pig Iron and Scrap, f.o.b. Cincinnati

1912	Southern No. 2. Gross ton	Northern No. 2. Gross ton	No. 1 railroad wrought. Net ton	No. 1 cast scrap Net ton
January	$13.25	$14.20	$9.75	$9.75
February	13.25	14.20	9.50	9.75
March	13.37½	14.51¼	9.67½	9.87½
April	13.75	14.70	9.87½	10.25
May	14.15	14.55	10.40	10.80
June	14.25	14.57½	10.67½	10.87½
July	14.68¾	14.70	10.50	10.75
August	15.00	15.00	10.70	10.95
September	15.87½	15.95	11.25	11.00
October	16.80	17.10	11.90	11.35
November	17.25	17.95	11.68¾	11.43¾

The Sheet and Tin Plate Trades in 1912

BY B. E. V. LUTY

The outstanding feature in the record of the sheet and tin plate industries in 1912 has been the difficulty in securing prices for the product commensurate with the cost of raw materials. While there was a steadily advancing tendency in black and galvanized sheets from early in the year until the close, and advances were made in tin plate prices in April, July and September, the advances were not in full proportion to the advances in raw materials. Black sheets continued to be low in proportion to the cost of sheet bars, galvanized sheets showed an insufficient spread above black, having regard to the cost of spelter, and the season price on tin plate for 1913 was the lowest, relative to steel and pig tin prices, for many years if not in the whole history of the industry.

In both sheets and tin plates the production has continued to gain in proportion to the total finished steel output of the country. This relatively rapid growth has prevailed for several years. In 1911, when nearly all finished steel products fell far behind their best previous year, tin plate made a new record by a wide margin, and sheets came close to their record. The official figures of sheet and black plate production are given below, with our estimates for the 1912 output, an approximation in the case of sheets, but a close estimate in the case of black plates.

Production of Black Plates and of Sheets, 13 Gauge and Lighter, Gross Tons.

	Sheets.	Black plates.	Total.
1905	983,437	507,587	1,491,024
1906	1,074,525	576,079	1,650,604
1907	1,084,700	504,072	1,588,722
1908	864,901	513,771	1,378,672
1909	1,248,404	606,844	1,855,248
1910	1,435,619	712,137	2,147,756
1911	1,358,110	795,598	2,153,708
1912	1,700,000*	900,000*	2,600,000*

*Estimated.

The black plate figures include, in the main, only black plates actually tinned, a large tonnage of tin mill products, with various finishes, being included with sheets.

The disproportionate growth in sheet and black plate production is illustrated by comparing 1906 and 1911. The total output of rolled iron and steel in 1906 was 19,588,468 gross tons, and in 1911 (an off year, of course) it was 19,039,171 tons, showing a decrease of 2.8 per cent. In the same period, however, the production of sheets increased 26.3 per cent. while black plates for tinning increased 38.2 per cent. Our estimates for 1912 show a further increase, from 1911 to 1912, of 25 per cent. in sheets and of 13 per cent. in black plates.

Increased Output Per Mill

The recent increases in total output have not been chiefly through an increase in the number of operative mills. The major portion of the increase has occurred through the average output per mill being increased, and this increase again has occurred in a double way—by more steady operation throughout the year, and by outputs per turn being increased. In years like 1906 the sheet mills ran practically full, but the tin mills did not. Prior to the past three years the tin mills were accustomed to several slack periods each year, namely, early in the year, in midsummer, and late in the year, together, frequently, with a slight lull in September. In 1910-11-12 the tin mills ran almost full throughout the year.

The output per mill per turn has been largely increased, and in several ways. The mills have been made heavier. The employment of helpers by the men has greatly increased, and, finally, ventilating systems have been introduced very largely, bringing up the outputs quite considerably in hot weather.

The United States Steel Corporation has contributed about the same proportions to the total output in the past four years, about 60 per cent. of the tin plate output and about 40 per cent. of the sheet output. As with the independents, its output has increased chiefly through obtaining greater production per mill. The last year in which the corporation made as much as 50 per cent. of the country's sheet total was 1907, when its proportion was 50.6 per cent. The next year the proportion dropped to 41.3 per cent. The last year in which its proportion of tin plate was as much as 75 per cent. was 1903, when it showed 77.6 per cent.; 1908 showing 67.6 per cent., or just over two-thirds, while in 1909 the proportion dropped to 60 per cent.

The average openly quoted prices on sheets and tin plates during the year were as follows, compared with the average in 1911:

Months.	Black sheets, 28 gauge. Cents per lb.	Galvanized sheets, 28 gauge. Cents per lb.	Tin plates, per base box, 100 lb.
January	1.90	2.90	$3.40
February	1.85	2.86	3.32
March	1.80	2.80	3.30
April	1.85	2.87	3.30
May	1.90	2.94	3.38
June	1.90	2.95	3.40
July	1.96	3.01	3.48
August	2.03	3.12	3.50
September	2.12	3.25	3.59
October	2.20	3.35	3.60
November	2.25	3.40	3.60
December	2.25	3.40	3.60
Year 1912	2.00	3.07	$3.46
Year 1911	2.03	3.03	3.61

Thus the average price on black sheets was 3c. per 100 lb. less in 1912 than in 1911, while the average on galvanized was only 4c. more. Tin plates showed a decrease of 15c. The 1912 prices averaged considerably higher all along the line than prices in the closing months of 1911, but that year's average was helped by the fairly good prices of the early months, relics of the boom of 1909. The lowest prices on the recent decline were made in November, 1911, when they went as low as 1.70c. on black sheets, 2.75c. on galvanized sheets, and $3.25 on tin plates.

Steel and Sheet Prices

The lowest priced material, averaging 1.80c. on black sheets, 2.80c. on galvanized sheets and $3.30 on tin plates, was made from sheet bars costing not over $20 delivered. It was commonly stated at the time that the sheet mills were losing money. At any rate, the advance to 2.25c. is only $9 per net ton, whereas at the close of 1912 it was difficult to buy sheet bars at $30 delivered, though there was practically no demand at that figure, which showed an advance of $10 per gross ton in steel against $9 per net ton advance in sheets. Thus the sheet mills have had little chance to make a profit. It should be observed, of course, that prices quoted for the closing months of 1912 are for

far forward delivery; for early deliveries, mills were obtaining premiums of about $2 a ton on black sheets and $4 a ton on galvanized sheets.

During the first six months of 1910 a spread of $1.10 per 100 lb. obtained between black and galvanized sheets. In the second half of that year, with a falling market, the spread decreased, reaching $1 at the close of the year, and it remained at this amount throughout 1911 and until April, 1912. On the 11th of that month the American Sheet & Tin Plate Company advanced its prices to 1.95c. on black and 3c. on galvanized; July 16 it made advances to 2.05c. on black and 3.15c. on galvanized; September 10 it made advances to 2.15c. on black and 3.30c. on galvanized. To the earlier of these advances the market responded but slowly, but to the last it responded promptly, as it did also to the advance of October 11, making black 2.25c. and galvanized 3.40c.

Thus during 1911 and the first three months of 1912 the spread between black and galvanized was $1, while by the close of September, 1912, a spread of $1.15 was established.

A phenomenal advance occurred in the price of spelter, and this bore very heavily on the manufacture of galvanized sheets. The advance started in October, 1911. The average price of spelter at East St. Louis during the first nine months of 1911 was precisely 5½c. per lb., the spread between black and galvanized sheets during the period being $1 per 100 lb. The advance in spelter was rapid and practically continuous for almost a year, the top point being reached late in September, 1912, at about 7½c., a total advance of 2c. per lb. A comparison of spelter prices and the spreads between black and galvanized sheets over a period of years, prior to this recent movement, indicates that on an average a spread of $1 per ton between black and galvanized sheets corresponds with a 5c. spelter price, and that an advance of 5c. in the spread corresponds with an advance of 0.40c. in spelter. Thus during the first nine months of 1911 the spread was somewhat low, at $1, when spelter averaged 5½c. When, however, in September, 1912, the spread advanced to $1.15 the price of spelter reached 7½c., and according to the theoretical base mentioned such a price should correspond to a spread of about $1.30. The makers of 28-gauge galvanized sheets were thus "out" about $3 a ton. Some of them began to show a decided indisposition to sell galvanized sheets, except at a premium above the regular market, and while black sheets commanded premiums for early deliveries, galvanized sheets commanded still greater premiums.

Since the top point in spelter was reached, late in September, the market has shown uniformly a declining tendency, but the decline has been less than half a cent a pound, not sufficient to afford the relief required.

The Tin Plate Position

The tin plate mills had, on the whole, a fairly good year in 1912. They received about 15c. a box less for their product than in either of the two preceding years, but they secured their steel at lower prices—enough lower almost to make up both for the lower realized price on tin plate and for the higher price which had to be paid for pig tin. The tin they consumed in 1912 cost them an average of about 45c. per lb., against between 42c. and 43c. in 1911 and about 33c. in 1910.

The outlook for the tin plate mills for 1913 cannot be considered flattering. They are promised a very heavy output, but from competitive or other trade conditions they have practically been forced to sell much of it on contracts taken at prices entirely out of proportion to the new costs of raw materials. The average realized price on the 1912 output, including the very largest contracts, made at special prices, was about $3.25, whereas the average price to be realized on the 1913 output is not over $3.55 at the outside, unless fancy prices should be realized on the small proportion of the make yet to be sold. This is an increase of not over 30c. per box, as an outside estimate.

From the outlook at the close of 1912 the prospect is that sheet bars will cost $8 to $10 per ton above prices paid for the bulk of the 1912 steel, while the mills are confronted with 50c. tin against an average of 45c. tin for 1912. The advance in steel, at 20 boxes to the ton, means 40c. to 50c. per box of tin plate, while the pig tin advance, at 2 lb. per box, means 10c. Both of these are very conservative estimates. Thus the raw materials will stand the tin mills at least from 50c. to 60c. per box more than in 1912, while the advance in realized prices on tin plate is 30c. a box at the outside. The change is from 20c. to 30c., perhaps more, against the tin plate mills, and this is a very large amount.

To suggest a roughly approximate quantitative conception, it may be mentioned that in a general way 1c. per box on tin plate means about 1 per cent. on the total investment, taking a concern which buys its steel, so that a very serious condition is presented. This is the more striking when it is observed that it occurs in an industry which is making record tonnages every year, with a remarkable increase in the demand for its product.

Exports

Early in 1911 a noteworthy reversal occurred in the tin plate movement. During 1910 tin plate exports averaged 1000 tons a month, while imports, almost exclusively for the rebate trade, which receives a drawback of 99 per cent. of the duty originally paid, upon the exportation of containers and other products made from imported tin plate, averaged 5500 tons a month. From January to February, 1911, these imports dropped from 5677 gross tons to 873 gross tons, and next month the exports jumped to 5531 tons. The changed relation continued through 1911 and 1912. In the first 10 months of 1912 tin plate imports amounted to 1784 tons and tin plate exports to 72,519 tons, or 7000 tons per month excess of exports over imports. This contrasts with 4500 tons per month excess of imports over exports in 1910, a reversal of 11,500 tons a month, or 138,000 tons a year. In substance, this is an amount of business added to the American mills and subtracted from the Welsh mills, but this has neither turned the heads of the American mills nor injured the Welsh producers, who are quite prosperous.

The Copper Trade in 1912

BY L. M. ATHERTON*

The year 1912 in the copper trade has been the most satisfactory, from the producers' standpoint, which has been experienced since 1907. Three new high records have been made in the industry in the United States—production, deliveries for domestic consumption, and total deliveries. There has been throughout the year a good demand for the metal at good prices.

The year opened with stocks of the consumers very low, and the result was that when new supplies of copper were needed for consumption they had to come out of the so-called surplus stocks. Takings for domestic consumption, therefore, have been enormous, so that it is quite likely that when the year's statistics are made up it will be found that between 825,000,000 and 835,000,000 lb. of copper has been delivered in the United States, against 709,600,000 lb. in 1911, an increase of about 120,000,000 lb., or 17 per cent.

Exports, although large, will be somewhat less than in 1911—probably in the neighborhood of 735,000,000 lb., a 20,000,000-lb. decrease compared with 1911, or practically 3 per cent. It was hardly to be expected that the 1911 record would be kept up, however, although it should be noted in this connection that foreign consumers drew on home stocks in 1912 so that the foreign visible supply during the year decreased very close to 40,000,000 lb.

Large Refinery Output

The high record refinery output was natural, because the new porphyry properties—Chino, Ray Consolidated, Miami, Utah Copper and others—have become increasingly important factors in the industry, whereas during 1911 only Utah Copper and Nevada Consolidated of the

*Boston News Bureau.

porphyries were substantial producers. Refinery output this year will be very close to 1,575,000,000 lb., an increase over 1911 of 140,000,000 lb., or 10 per cent. This is in sharp contrast with the record of 1911, when the normal increase in refinery output not only failed to materialize, but showed an actual decrease as compared with 1910.

Surplus stocks of copper in the United States during the year have made a slight increase—certainly not a bad showing in the face of the enormous production. The movement of copper in the United States in 1912 may be estimated as follows:

	Pounds
Stocks January 1, 1912	89,000,000
Production (refinery output)	1,575,000,000
Domestic deliveries	830,000,000
Exports	735,000,000
Total deliveries	1,565,000,000
Excess production	10,000,000
Stocks January 1, 1913	99,000,000

On January 1, 1912, the foreign visible supply of copper was 128,000,000 lb., which has since shown an almost uninterrupted decrease, so that at the beginning of 1913 foreign stocks are not greatly in excess of 88,000,000 lb., a net decrease during the year of 40,000,000 lb. There is, therefore, an indicated decrease in the world's visible supply of copper for the year of 30,000,000 lb. in round numbers, as shown by the following table (partly estimated), in which the quantities are stated in pounds:

	United States	Foreign	Total
Stocks January 1, 1912	89,000,000	128,000,000	217,000,000
Stocks January 1, 1913	99,000,000	88,000,000	187,000,000
Decrease for year	*10,000,000	40,000,000	30,000,000

*Increase.

The Course of Prices

The strength in the copper situation was acquiring power in the closing months of 1911, and the year 1912 opened with the price level firmly established above 14c. per lb. It took a long while, however, to convince the skeptical that after four years of depression the copper market was again headed for higher prices.

In January the average was better than 14c.; in April it was maintained above 15c.; another advance to above 16c. took place in May, since which time copper has not sold below 17c., and in September the peak of the movement was reached, with an average of better than 17½c. Since September buying has been somewhat less aggressive, and the year goes out with the price level at 17½ to 17¾c. The average for the entire year will be about 16¼c., which compares with 12.61c. and 12.74c. in 1911 and 1910 respectively.

Mine Developments

No important new properties were discovered during the year, no important mergers took place, and none is in prospect. All the larger mines put out practically every pound of copper of which they were capable, and outside the porphyries there is apparently no prospect for any material increase by individual mines for 1913. Indeed, during 1912 some of the Lake Superior properties were under their 1911 figures, due in part to shortage of labor as well as to lower grade of rock at depth.

The Outlook

The immediate future is a little mixed, with perhaps the weight of the argument favoring slightly lower prices. Temporarily, foreign orders for copper are held up on account of political conditions, and slowing down of business on this side of the water is also having effect. A settlement abroad would, however, bring in large orders for the metal and go far toward maintaining the price. A long range view is that there is no reason to be anything but hopeful respecting the future.

Lake Superior Charcoal Pig Iron Prices for Twenty-four Years

The following table, which has been compiled from quotations in *The Iron Age*, gives the average monthly prices of Lake Superior charcoal pig iron per gross ton, in carload lots, at Chicago, from 1889 to 1912.

	1889	1890	1891	1892	1893	1894	1895	1896	1897	1898	1899	1900
January	$20.00	$23.00	$18.50	$17.25	$16.50	$15.50	$13.00	$14.50	$13.50	$12.50	$11.50	$25.50
February	19.50	23.00	18.25	17.00	16.50	15.40	13.00	14.00	13.50	11.50	12.50	25.50
March	19.50	22.50	18.00	17.00	16.50	15.25	13.00	13.50	13.50	11.50	15.75	25.50
April	19.25	21.50	18.00	16.75	16.50	15.25	12.75	13.50	13.50	11.50	17.00	25.50
May	17.50	22.80	24.12	15.00	17.75	15.25	13.00	13.50	13.00	11.50	17.25	24.50
June	18.50	20.50	16.75	16.50	16.00	15.25	13.00	13.50	13.00	11.50	19.50	23.00
July	18.50	20.00	17.00	16.50	16.00	15.00	13.50	13.50	13.00	11.50	21.50	22.00
August	18.50	20.25	17.00	16.50	16.00	14.50	13.50	13.50	13.00	11.50	22.50	20.00
September	18.75	20.25	17.25	16.50	16.00	14.25	14.50	13.50	12.50	11.50	24.25	18.50
October	19.50	19.75	17.00	16.75	16.00	14.00	15.50	13.50	12.50	11.50	25.00	18.00
November	20.00	19.25	17.00	16.50	15.75	13.50	15.50	13.50	12.50	11.50	25.50	17.00
December	22.00	18.75	16.75	16.50	15.50	13.00	16.00	13.50	12.50	11.50	25.50	18.25

	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912
January	$19.00	$19.25	$25.60	$16.62	$18.50	$20.40	$26.80	$22.50	$19.50	$19.50	$17.87	$16.00
February	17.50	20.25	26.50	15.87	18.50	20.13	27.00	21.38	19.50	19.50	17.50	15.95
March	17.50	20.65	26.50	15.00	18.50	19.75	26.75	21.25	19.50	19.30	17.50	15.75
April	18.00	21.50	25.30	15.19	18.50	19.44	26.50	20.30	19.50	19.00	17.50	15.75
May	17.50	22.80	24.12	15.00	17.75	19.05	27.40	20.00	19.50	18.62	17.25	15.75
June	17.00	23.50	24.00	14.70	17.00	19.00	27.50	20.00	19.50	18.50	16.80	16.75
July	17.00	25.00	22.20	14.50	16.50	19.06	27.00	20.00	19.50	18.50	16.50	16.25
August	17.00	25.75	20.62	14.87	16.40	19.35	27.20	19.50	19.50	18.50	16.50	16.25
September	17.00	26.00	19.00	14.75	16.87	20.13	27.00	19.50	19.50	18.40	16.50	17.12
October	17.00	26.00	18.10	15.31	18.25	21.50	26.20	19.50	19.50	18.12	16.50	18.65
November	17.50	26.00	17.12	16.37	19.20	24.63	25.12	19.50	19.50	18.00	16.50	18.65
December	18.00	25.25	16.50	17.80	20.00	26.13	24.25	19.50	19.50	18.00	16.37	18.75

Wire Rod Prices for Twelve Years

It would be extremely desirable to give wire rod prices for at least 20 years, but it is found that quotations did not regularly appear in market reports until 1901. The table given below therefore represents the available figures as far as public prices are concerned. They are for Bessemer wire rods, per gross ton, at Pittsburgh, and are averaged from weekly quotations in *The Iron Age*.

Bessemer Wire Rods at Pittsburgh, Per Gross Ton

	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912
January	....	$33.45	$34.70	$30.00	$31.00	$33.75	$37.00	$34.30	$33.00	$33.00	$28.00	$24.37½
February	....	35.00	35.75	30.00	31.00	34.00	37.00	35.00	33.00	33.00	28.75	25.00
March	....	35.50	36.62½	30.80	31.70	34.00	37.00	35.00	33.00	33.00	29.00	25.00
April	....	36.00	37.00	31.00	34.00	34.12½	37.00	35.00	29.00	32.50	29.00	25.00
May	....	36.80	37.00	30.50	34.00	34.40	37.00	35.00	27.50	32.00	29.00	25.00
June	....	37.00	36.62½	29.20	33.30	34.00	37.12½	33.50	27.50	30.80	28.25	25.00
July	....	36.00	35.80	28.00	31.87½	34.00	36.50	33.00	29.40	29.25	27.00	25.00
August	....	36.00	35.00	28.00	32.10	34.00	36.10	33.25	31.00	28.25	27.00	25.80
September	....	35.87½	34.75	27.00	31.12½	34.00	36.00	33.00	31.50	28.00	27.00	27.00
October	$32.75	35.90	34.00	26.00	31.75	34.50	35.40	33.00	31.87½	28.50	26.00	28.50
November	33.00	35.50	31.62½	26.75	32.10	35.50	34.00	33.00	32.50	28.12½	25.30	29.75
December	32.62½	34.50	30.50	29.80	32.50	37.00	34.00	33.00	33.00	28.00	24.50	30.00

A Continuous Cost Keeping System

Outline of Continuous Cost Records and Inventory Maintained by the Automatic Transportation Company, Buffalo

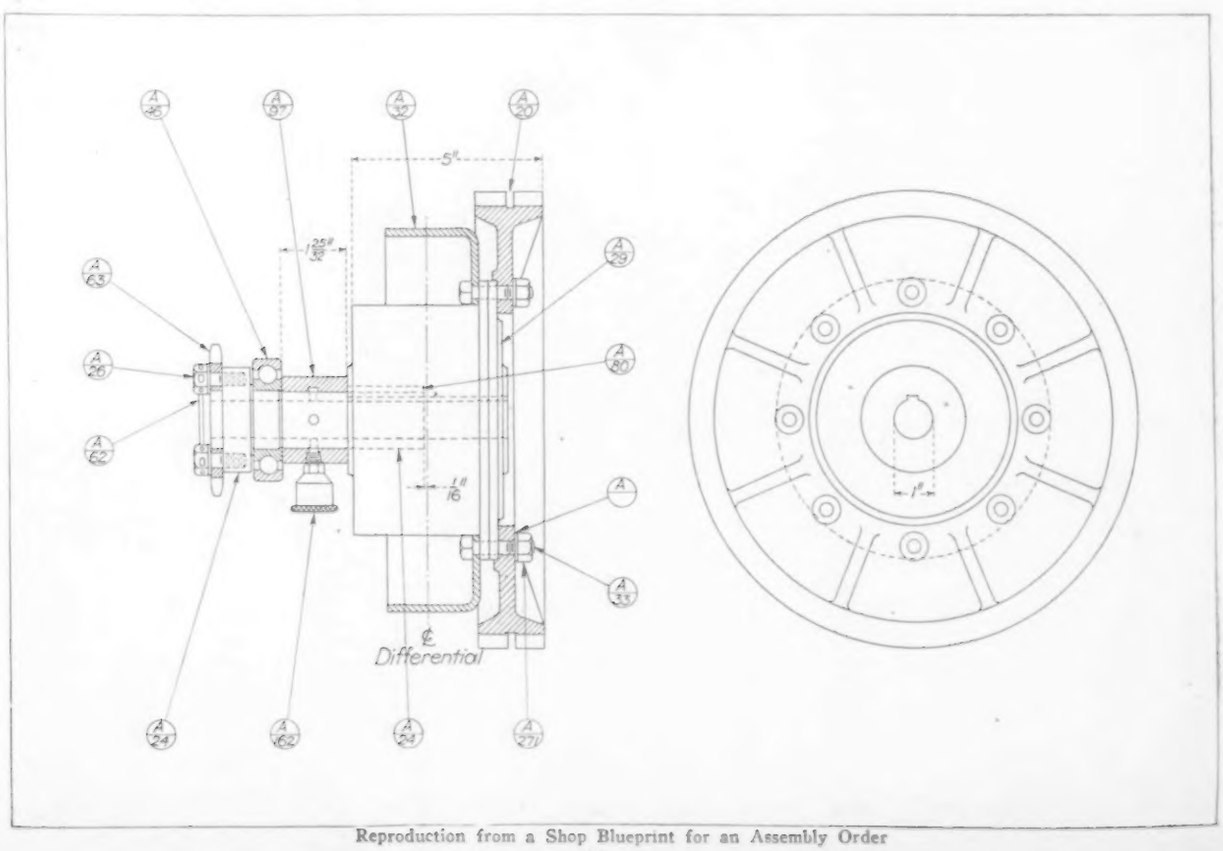
A system of cost keeping in a manufacturing problem involving considerable machine shop work and one which has been in satisfactory operation for some time and offers suggestions in view of the size of the establishment, to a large number of similar manufacturing institutions, is presented in outline in the accompanying illustrations. It is the system which has been evolved by the Automatic Transportation Company, Buffalo, N. Y.

One of the Automatic Transportation Products

The products of this company have at this writing been practically all devoted to the transport of materials in and about works and between works and in such situations as freight terminals, baggage transfer stations and the like. A proportion of the different parts going into the trucks, cars and other forms of transporting vehicles, are purchased more or less in a complete condition, and the manufacturing processes include the production of specially designed parts and the assembling of these and the purchased devices into finished products. The system of cost keeping, which also includes a continuous inventory, therefore covers costs of details wholly, in part or not at all made in the works, making it possible always to ascertain when it may become expedient to extend the process of manufacture to what may be termed the little things. Finally one detail of the system is that it is substantially a continuous cost record, the actual and proper cost to be met on any one article or series of articles being ascertained on the completion of the work, a simple office routine providing therefor.

The company makes at present two substantially distinct forms of transporting apparatus. One is a self-propelling car designed to travel on overhead rails carried by a single line of cast-iron columns. The columns carry a fork or yoke to which are fixed the rails and the overhead tramway is thus one peculiarly well adapted to cross-country travel, particularly in rolling or even moderately steep country with trying changes in the contour or topography. The other is a storage battery truck made in a variety of forms, to travel on industrial tracking or without rails.

While it is impracticable to attempt to describe all the interesting features of these trucks at this writing, a view is here given of one form of storage battery trucks. This shows the enclosure containing the battery and beyond this is a step on which the operator rides, having a lever in one hand for steering purposes and a lever in the other hand for speed control, besides a foot lever which serves merely as a switch for braking and cutting out the electric motor. Sometimes the truck is used not only for carrying goods on its own body but serves as the motor car for hauling a line of trailers. There are numerous interesting details to the truck equipment, as regards driving mechanism, the generous use of ball bearings and the like, and attachments to the truck itself. For example, the view shows an end piece built up of wrought pipe shrunk on hard wood sticks, which end piece may be swung into a horizontal position giving considerable added length to the

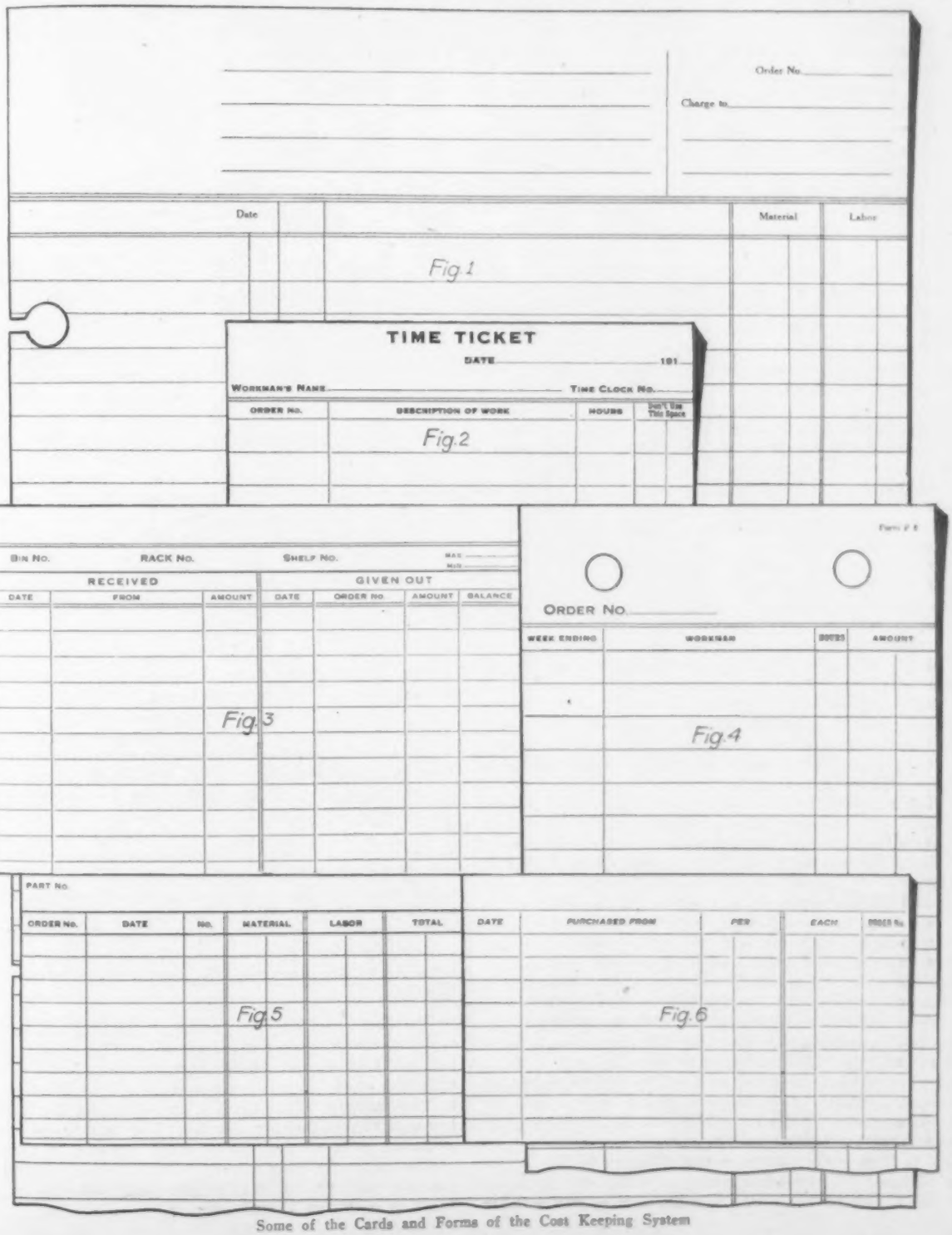


Reproduction from a Shop Blueprint for an Assembly Order

truck platform, or it may be tilted downward so that one end rests on the ground making a skid on which one may push or roll material to the truck platform.

Only a number of the cards and forms of the cost-keeping system are reproduced in this connection. The orders which go through the shop emanate, so far as the shop is concerned, from the purchasing agent who has also supervision over this phase of the manufacturing operation. Most of them have to do with the construction or assembly of component parts of, say, storage battery trucks. The necessity of replacing such parts is ascertained by or under the watchfulness of the stockkeeper, whose continuous inventory card for each particular article contains a notation of both the maximum number and the minimum number between which the stock on hand should lie. In the event that he discovers some such part needs replenishing, he makes out for transmission to the purchasing agent a simple form known as the supplies requisition. On receipt of this the purchasing agent makes out the factory order where the work is strictly a factory proposition, or he makes out the outside purchasing order where the requisition calls for purchasable supplies.

In the case of each of these types of order, the order is made in triplicate and they are numbered serially. A copy is retained by the purchasing agent, a copy goes to the stockkeeper and in the case of the factory order the third copy goes to the office and in case of the purchase order the original of course goes to the concern from which the goods are to be bought. In all cases each part of material purchased is given a letter and a number. All parts and material having to do with the trucks carry the letter A. Similarly all parts connected to the motor carry the letter B and the parts relating to the controller are designated by the letter C. This scheme is emphasized in connection with the reproduction of the blueprint, to which reference is to be made later, but which is here noted to indicate how the details and parts going to make up an assembly of a brake drum, sprocket and differential of an electric truck, for example, are under the A classification as relating to the truck and each carrying a distinctive number. In the office files there is a card index arranged by letters and numerically, this card index being the cost record. Any given part, such as the size and kind of nut shown in the drawing, is always known as A-26, or the



Some of the Cards and Forms of the Cost Keeping System

grease cup as A-162. A separate index is provided if it becomes necessary some time to ascertain what number any given part has, so that reference may be made to its cost records. The chief reason, as stated, for the reference to the classification scheme in this connection is to emphasize the general use of the shop nomenclature.

When the purchased articles reach the stock keeper he certifies to that effect on his copy of the purchasing order and this certification is notice to the purchasing agent that he may approve the bill and incidentally enter the cost and source of different articles upon a card index he has. A copy of this card is shown in Fig. 6. Across the top of the card is entered the name of the product or material and the purchasing agent may readily learn at any time where and when he purchased a given article, how much it cost and on what order it was placed, his orders being filed away or retained in numerical notation. The record is valuable when additional material is needed or when the sellers' representative or competitors quote new prices.

The receipt of the purchasing order by the office gives a record from which cost notation may be made in the cost system, should it be desired to keep records of this kind when no labor is involved. Such records are valuable when the time arrives to consider making the material in the company's own factory.

The factory order results in the foreman issuing to the different workmen requisitions on the stock room for different articles or parts required to make up the order. This requisition is a simple blank stipulating the quantity and description of articles which the stock clerk is to hand over on the foreman's signature. For example, the factory order may call for a certain number of assemblies of the brake drum, sprocket and differential. A blueprint of this part which is noted on the factory order as part A-406 is obtained. The blueprint is numbered A-406. A reproduction of it is the drawing on page 88; the table of the number of detail parts required, however, is omitted. This enumerates that one each of A-20, A-24, A-29, A-32, etc., is required, four of A-26, eight of A-33, etc. The requisitions on the tool room therefore cover these parts and the foreman's receipts give a memorandum from which the stockkeeper can post his continuous inventory card.

A copy of this card, which is 3¼ x 5¼ in. in size, is shown in Fig. 3. Across the top is the name of the article and its shop designation, and places for noting the definite location of the article in the stockroom by bin, rack or shelf. Here also is the place for noting the minimum or maximum number for this particular article. On the one side is listed the receipts and the other the disbursements, and the last column provides for noting the balance at all times, so that a new figure is placed in this column whenever the supply is increased or diminished.

In the meantime the factory order has gone into the office and the machine or part of machine, if desired is given an account in a loose leaf book of which the pages are about 10 in. wide and 14 in. high. Part of this page is shown in Fig. 1. As the records of material disbursements from the stock room are received, the cost of the material, as obtained from cost records for these parts, are entered. Incidentally the page becomes a permanent individual record of the cost of a consignment made to a given purchaser whose name is a part of the record, being placed at the top of the page.

The original entry on Fig. 1 is a sign that there will be labor charges and the information of the labor costs comes in the shape of time tickets, a copy of which is shown in Fig. 2, the original 3½ x 5¼ in. in size. A card for each order number for the labor charges, 4½ x 8½ in., is made out and a copy of this is indicated in Fig. 4. This card is posted from the time tickets, the identification being the order number. When the stock room records show that all parts on a given order have been requisitioned and the purchasing agent has certified to that effect by sending in the stock room's copy of the factory order, which certification becomes easy matter with his familiarity of the product, it is a sign to the office that the work is completed and that it should shortly receive the last time ticket and can therefore close the account. When, as sometimes happens, a belated time ticket reaches the office, it calls for an explanation. The latter is likely to be illuminating regarding some practice needing correction.

It is from such records as that afforded by Fig. 1 that the cost cards are compiled, a copy of which card is shown in Fig. 5. As already stated they are filed by part number and give the material and labor cost and then the total cost and include a cross reference making it possible to refer always to the order number for details. The costs are kept per unit and commonly require four decimal places, which afford a means for quickly detecting changes in cost and instituting an investigation to ascertain the reason. These cards are 3 x 5 in. in size.

The total cost entered on the card is not only the sum of labor and material costs but includes the overhead charges, figured for convenience as percentage of the total base charges for material and labor. This overhead account is obtainable monthly and the percentage factor may be changed from time to time if necessary. In fixing the overhead factor a depreciation of 5 per cent. is charged against buildings, machinery, furniture and fixtures and 10 per cent. against tools and patterns. Finally it is to be noted that this system gives the gross cost of any part or completed article but does not include any of the expenses incident to selling. The selling department is independent and must fix its prices so that a profit will result after meeting the cost of distribution.

The products of the Automatic Transportation Company, the offices and factory of which are at 2933 Main street, Buffalo, represent the inventions largely of William C. Carr, president of the company. The vice-president of the company is George W. Carr, its secretary and treasurer is Joel H. Prescott and the manager of sales is L. J. Goodsell. The cost system was evolved by Edgar L. Kleindinst, assistant secretary and treasurer, and the foregoing outline, covering the system substantially but not strictly as applied by the company, is offered as stated for the suggestions it should offer to others.

A Great Mexican Hydroelectric Project

The Mexican Northern Power Company is constructing an electric power transmission line to Parral from the hydroelectric plant which it is building on the Conchos River, about 18 miles from Santa Rosalia, Chihuahua. It will also extend lines of this character to Chihuahua, Jiminez, Santa Barbara, Santa Eulalia and a number of other cities and mining districts of the state of Chihuahua.

The company is now working more than 1500 men night and day on its great dam at La Boquilla. This will be one of the largest masonry dams in the world. Its hight will be 261 ft. It will have a width of 19 ft. on the crest and 200 ft. at the bottom. It is curved convex upstream to a radius of 866 ft. The structure will contain about 390,000 cu. yd. of masonry and the water storage reservoir it will create will have a capacity of about 2,800,000,000 c. m., which will flood an area of 58 square miles. Besides this main dam a subsidiary dam is being built to prevent overflow at a low gap between two hills about one-half mile from the main dam. This subsidiary dam will be 2610 ft. long and 108 ft. high.

The hydroelectric plant will have a capacity, it is stated, of more than 100,000 hp. Besides the electrical power feature of the project, the company will irrigate about 200,000 acres of land from its water storage supply. This land is situated in the valley of the Conchos River and is said to be susceptible of producing large crops of various kinds when irrigated. The construction of extensive systems of canals and ditches is involved in the plans.

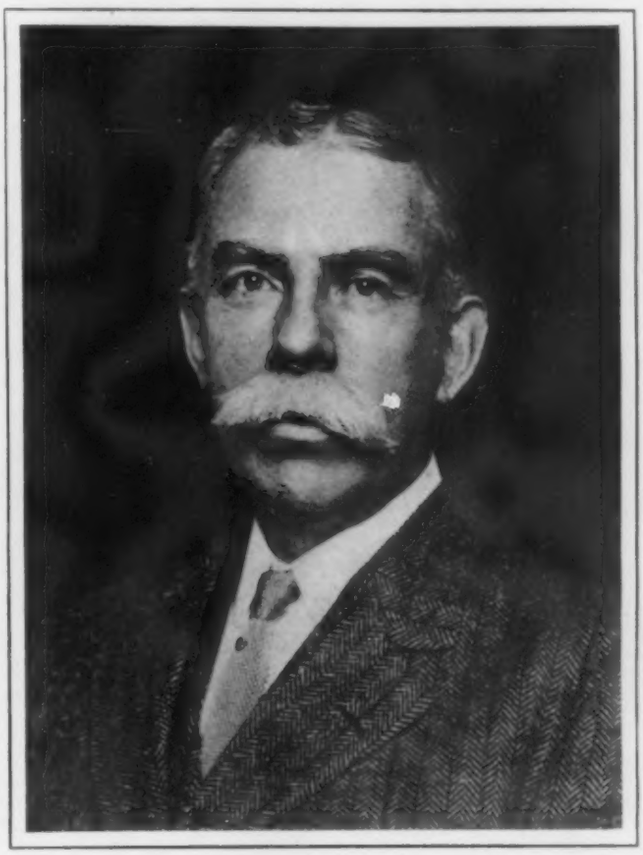
The work of constructing the dam was started in the fall of 1910 and it is planned to have the entire project finished about July 1, 1913. The Mexican Northern Power Company is composed of Canadian people and it has its principal office in Montreal, Canada. William B. Fuller is chief engineer. The contractors are S. Pearson & Son of London, England, and the city of Mexico. P. L. Bloston is general superintendent. Considerable interference with the carrying on of the work of construction on account of the activities of bands of rebels has been met with from time to time.

The cost of making pig iron in the Birmingham district, says our correspondent at Birmingham, Ala., has risen in the past few months, owing largely to the higher cost of coke and partly to other expenses involving the securing of raw material. One furnace operator says the increase has been as much as 65c. per ton. The year closed with a minimum price of $14, Birmingham, for No. 2 foundry, against $10 at the close of 1911; with but 70,000 tons of pig iron on hand, against over 200,000 tons, and with 23 furnaces in operation against only 18.

William G. Gray

Bureau of Statistics of American Iron and Steel Institute Put in His Charge

As recently announced in these columns, arrangements have been made for the continuation at the long familiar offices, 261 South Fourth street, Philadelphia, of the statistical work of the American Iron and Steel Association but under the auspices of the American Iron and Steel Institute. On January 1 the resignation of James M. Swank, vice-president and general manager of the American Iron and Steel Association, became effective and it was decided by the directors of the American Iron and Steel Institute to establish a statistical bureau in the present office of the American Iron and Steel Association, placing in charge of the work William G. Gray, who for a number of years has been statistician of the American Iron and Steel Association. Mr. Gray's relations with the iron and steel manufacturers of the country have been such, in the years in which he has so efficiently assisted Mr. Swank, as to make his appointment a matter of gratification to all who have had to do with the Philadelphia office. He is thoroughly familiar with the lines of operation in iron and steel manufacture in this country and has closely followed all the changes of the important period covered by his connection with the association.



WILLIAM G. GRAY

He entered the Philadelphia office as a proofreader and correspondence clerk in February, 1887. A few years later he was made assistant to William M. Benney, who then had charge of the collection of statistics for the association and who is now assistant secretary of the National Association of Manufacturers. Mr. Swank made Mr. Gray his chief statistical assistant in 1892 when Mr. Benney resigned. In 1901 Mr. Gray was made statistician of the association. He was appointed by the Government as expert special agent for iron and steel for the Census of 1900 and he prepared the first census report on the tin plate industry of the United States.

Mr. Gray was born in Philadelphia in 1858. He learned the printer's trade, and some of his early typesetting was on the weekly Bulletin of the American Iron and Steel Association and on the Directory to the Iron and Steel Works of the United States. At the age of 22 he was made foreman of the book department of Allen, Lane & Scott, which for years printed the various publications of the American Iron and Steel Association.

Added to his familiarity with all the ramifications of the American iron trade in its varied lines of production Mr. Gray brings to the work now placed in his charge the statistical habit of twenty-five years. This experience is invaluable to the American iron trade and insures the continuance on broad and progressive lines of a statistical work which has been the model of statisticians and students of our iron trade history in all countries.

According to the Frankfurter Zeitung, the German North Sea and Baltic Sea shipbuilding firms continue to complain about unsatisfactory returns, particularly for vessels of the largest dimensions. Owing to the keen competition for the building of German war vessels, prices are quoted by inexperienced builders which do not take adequate account of the cost. A movement was started some time ago in Berlin to form a syndicate among the shipbuilders, but so far nothing has resulted.

Shippers Favor Better Treatment of Railroads

Names are made public by the Railway Business Association, the national organization of equipment manufacturers, of 4000 shippers and receivers of freight in nearly every State of the Union, who declare in favor of a policy which will permit the railroads "adequate revenue to meet existing obligations and to attract capital for necessary improvements and extensions." The list of signatures accompanies the annual report of the general executive committee, which asks whether the time has not come for the Interstate Commerce Commission to put such a policy into effect. The committee says:

"Some newspapers have interpreted this declaration by shippers as intended to prepare the public for some general advance in freight rates. This is a misunderstanding. It is just to these shippers to make clear that they have not been asked to say anything about such an advance. The Railway Business Association does not know that any advance is under consideration by the roads. No railroad manager heard of this declaration until it was in the mails. We would not express an opinion upon particular schedules if filed. What these shippers urge is all comprised in the declaration which they have signed as follows:

"'The undersigned shippers and receivers of freight, in our own interest, respectfully urge a policy toward railroads which, while emphasizing the necessity for their regulation to prevent discrimination and excessive charges, to safeguard life and to promote the convenience and comfort of the public, will give careful heed to the promotion of their prosperity and growth; ascertain in considering enactments compelling expenditures that they possess the resources to meet such outlays without injury to efficient service; provide that in all adjustments of rates adequate revenue shall be insured them to meet existing obligations and to attract capital for necessary extensions.'

"The Interstate Commerce Commission has said that it will act for the strengthening of railroad credit if expenses should so increase as to convince it that the time has come. These shippers' signatures may well suggest that the hour has struck for formulating such a policy.

"It is for our association to go on assembling and making known the concrete evidence of a constructive public sentiment on this subject. This year has brought an improvement in business. Tonnage has increased and with it gross railroad earnings. A clear perception of our problem, a steadfast adherence to our purpose, demands that now even more than in time of depression we do our utmost to make this period of business prosperity a time not of 'fair average return' to the railroads, but of liberal earnings and substantial upbuilding of surplus with which when lean months come the roads may operate efficiently, maintain upkeep and accomplish for each year that year's fair quota of additions and extensions."

New Coke Oven Plant at Sydney, Nova Scotia

The Latest Type of the United Otto System Built by the Dominion Iron & Steel Company Limited

BY F. E. LUCAS*

The latest addition to the coke oven plant of the Dominion Iron & Steel Company consists of 120 ovens with all the necessary by-product apparatus for the saving of surplus gas, tar and ammonia, the latter in the form of ammonium sulphate. The ovens are built high up from the ground, supported by three concrete walls running the full length of each battery of 30. On these walls are laid steel I-beams on which the brick-work is built. The ovens were thus elevated so that the coke could be handled into cars with the least amount of labor. At the same time, it permitted the bottom of the regenerators to be above the ground water level and the gas and air flues to be so near the ground level as to be free from all danger of water.

The ovens are of the latest United Otto type. Each takes a charge of approximately nine gross tons of coal. They are 34 ft. long, about 9 ft. high and 17 in. mean width, having 2 in. taper in the length. They were constructed with the guarantee of coking the charge in 24 hours, the coke to contain less than 1.5 per cent. volatile. We find that they will easily coke the charge in 20 hours with coal containing from 13 to 16 per cent. moisture.

The walls and top arches of the ovens are built entirely of silica brick. The gas for combustion is admitted both from the bottom and the front of the oven, and is capable of exact regulation with very little trouble. The arrangement of flues and combustion chambers for the mixing and burning of the air and gas is such that we get very uniform temperatures in all parts of the oven, and the quality of the coke, in so far as it is affected by the heating conditions, is excellent. While the quantity of the surplus gas (i.e., the gas over and above that required for heating the ovens) is satisfactory, yet we shall be able to do much better in this respect as soon as our coke requirements will permit of our running the plant to or near to full capacity.

Fig. 1—View of One of the 30-Oven Batteries

Pushing and Charging Mechanism

In pushing the coke the door on the pusher side is lifted off by a crane on the pusher, and when the pusher is placed so that the ram will be opposite the oven to be pushed, the door hanging on the crane is far enough to one side to be out of the way. When the oven is pushed and the ram drawn back, the machine is shifted to its first position and the door replaced. At the opposite side of the battery the coke is received in a Moore quencher, which removes the door in the same manner as the pusher, and is then placed opposite the oven door so that the pusher ram pushes the charge directly into the chamber of the quencher. The drop doors at each end of this chamber are then closed and after replacing the oven door the machine moves to the quenching station, where connection is made with a water hydrant. The water is admitted into the top of the chamber, the steam escaping through three exhaust heads on top. After the coke has been sufficiently

*Superintendent Coke Oven Department, Dominion Iron & Steel Company, Limited.

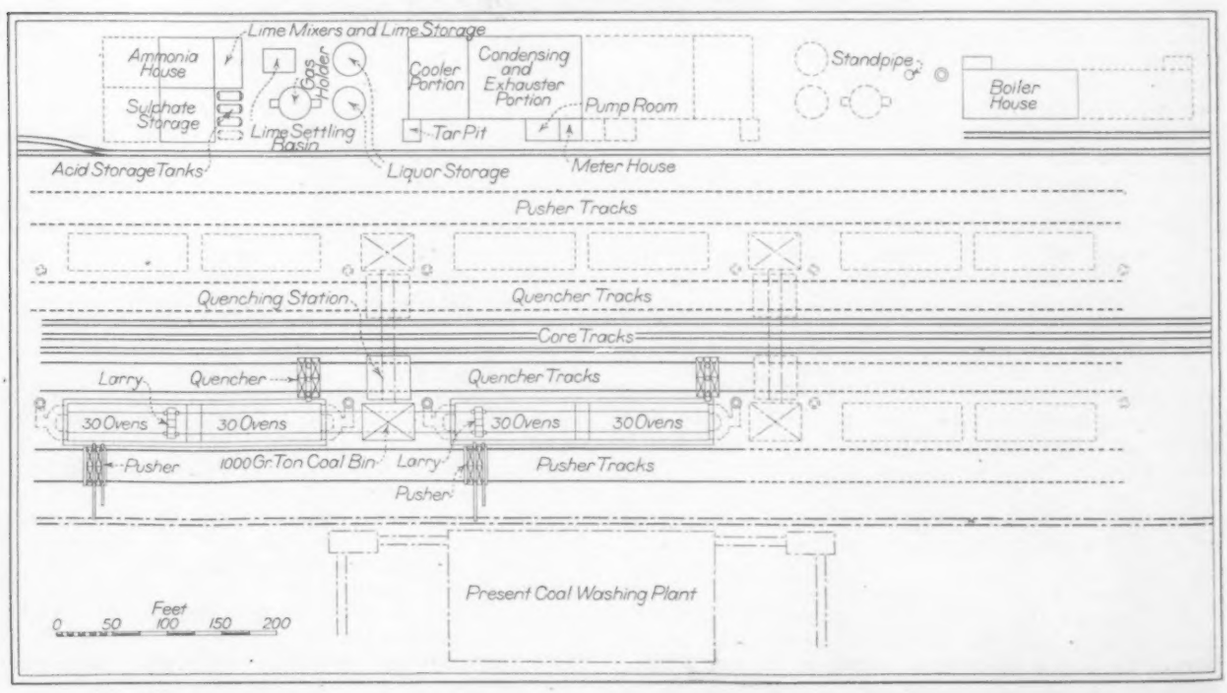


Fig. 2—Plan of New and Proposed Coke Oven Plant of the Dominion Iron & Steel Company, Sydney, N. S.

quenched the machine is run along the line of cars, and the bottom, which is a heavy chain conveyor, is started in motion and the coke delivered into the cars.

The charging is done from the Top. There are five charging holes in each oven, and one larry carries the full charge from the coal storage bin to the oven. The five chutes on the larry are opened by the operator at once by turning one wheel, and the coal falls into the oven where it is leveled by an electrically driven leveling bar attached to the pusher.

Gas Condensers and Washers

The gas is taken off by a standpipe into a single collecting main, from which it is drawn to the condensing plant by exhausters. There it passes through the coolers of which there are two sets. The first are serpentine air coolers, in which the gas is cooled from about 250 deg. to 160 deg. F. These coolers are so arranged that if necessary in hot months the cooling effect can be increased by spraying water over the outside. The gas then passes into a water tube cooler, in which it is cooled to about 60 deg. It then passes on to the tar scrubbers. Although a considerable portion of the tar is taken out in the coolers, a part of it, mainly the lighter tar fog, is finally taken out down to the last trace by the scrubbers. These are wet scrubbers, in which the gas is drawn through a series of pipes, and then through a liquor seal. This operation is repeated in each of the five sections of the scrubbers. Five minute paper tests taken on the gas after it has passed the scrubbers rarely ever show any tar going forward.

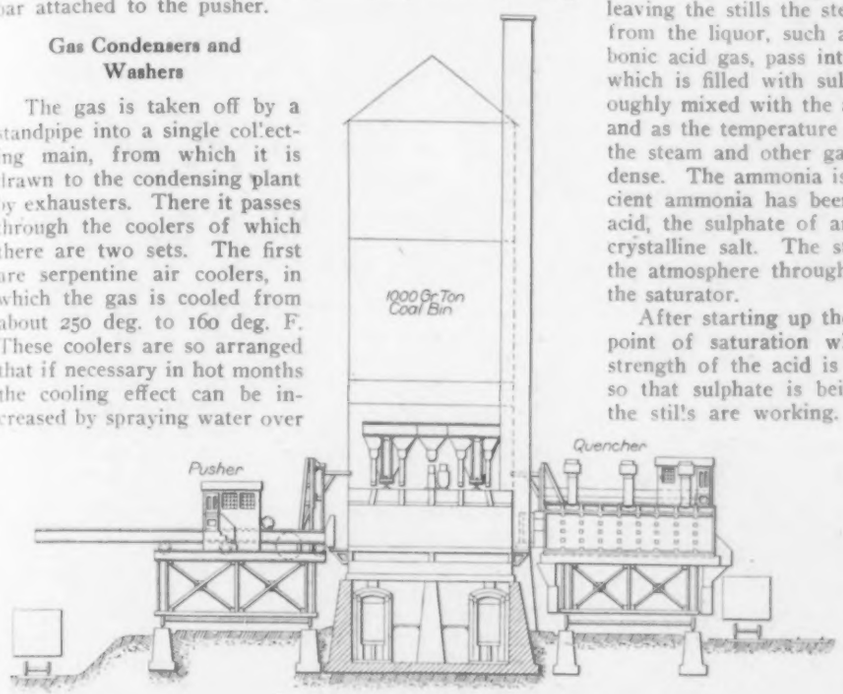


Fig. 3—Elevation Showing Coal Bin, Charging Larry, Pusher and Quencher

The gas then enters the exhausters and is forced under pressure through the ammonia washers. These are of the Bell type. There are fifteen sections in each washer, and in each section the gas rises into the under side of a number of bells and is forced out through a water seal. In this way there is no possibility of any gas passing through without coming into most intimate contact with the water. The gas leaves these washers containing an average of less than 7 grains of NH_3 per 1000 cu. ft. From here it passes through meters—one to show the amount burned under the ovens for maintaining the coking temperatures, and the other to show the quantity of surplus gas. This gas has an average calorific value of 525 to 550 B.t.u. per cu. ft. It is used in connection with the steel department for burning lime for the basic Bessemer (for which purpose it is purified), and for heating the mixer, drying ladles and various other purposes. At times, when the quantity is sufficient, it is also used in the open-hearth furnaces.

Ammonia Distillation

The ammonia liquor, or water which has absorbed the ammonia from the gas, is pumped to the sulphate plant and there distilled to recover the ammonia. On account of the excessive moisture content in our coal as it comes from the washer to the ovens, the liquor is much weaker than it would be under more favorable conditions working with dry coal. While this does not affect the amount of ammonia recovered, it does, to a certain extent, increase the difficulties in recovering the ammonia in a marketable form. It means the consumption of a greater quantity of steam to raise all this extra water in the liquor to the boiling point to liberate the ammonia.

The liquor is distilled in single tower stills. In the first five sections on the top the liquor is boiled and the volatile ammonia liberated. In the next two sections it is thoroughly mixed with milk of lime, and in the lower six sections the mixture of liquor and lime is re-distilled and all the fixed ammonia liberated. All the ammonia passes upward through the still with the steam, and after leaving the stills the steam and ammonia and other gases from the liquor, such as sulphuretted hydrogen and carbonic acid gas, pass into the lower part of the saturator, which is filled with sulphuric acid. The gases are thoroughly mixed with the acid by means of perforated pipes, and as the temperature of the acid is above boiling point, the steam and other gases (which are acid) cannot condense. The ammonia is fixed by the acid and when sufficient ammonia has been absorbed to almost saturate the acid, the sulphate of ammonia is precipitated as a white crystalline salt. The steam and other gases pass out to the atmosphere through an exhaust drum on the top of the saturator.

After starting up the plant and getting the acid to the point of saturation where the salt is precipitated, the strength of the acid is maintained uniform at that point, so that sulphate is being made continuously as long as the stills are working. From time to time as sufficient sulphate settles to the bottom of the saturator it is ejected by a steam syphon into drain boxes set at such an elevation that any acid liquor will drain back to the saturator. From the drain boxes the sulphate is dropped into centrifugal dryers which are also at such an elevation that the acid liquor will drain back to the saturator. The dryers are of the top-driven bottom discharge type, so that when the sulphate is dry enough it is dropped into barrows and wheeled to the stock house adjoining, in which it is bagged for shipment. The total ammonia recovered as sulphate amounts to about 1.1 per cent. on the coal carbonized.

Results with Higher Heats and Shorter Coking Time

When the entire plant was first put in operation we were confronted with certain questions and difficulties which on the old plant, with its lower heats and longer coking time, did not trouble us, such as the effect of the moisture on the brickwork and the quality of the coke due to shorter coking time. We are getting a harder coke than under the conditions prevailing on the old plant, but it is in smaller pieces, which I think might be expected, particularly with a high volatile coal such as we use.

By using a different shape and quality of brick for the oven chamber bottoms than is used in the standard design for dry coal, we have, I believe, entirely overcome any serious effects from the high moisture in the coal, in so far as it affects the brickwork.

In addition to the new ovens we have put in operation in the past year a new sulphuric acid plant to make the acid for our ammonium sulphate plants and for pickling rods in the wire mill. The plant is the Falding single chamber type, having a capacity of 40 tons per day. The acid is made from Louisiana brimstone, almost chemically pure, so that it contains no arsenic or other foreign matter.

The Barre Wood Combing Company, Barre, Mass., has paid fines of $20,000, the penalty imposed by the United States District Court at Boston for bringing aliens into the country in violation of the contract labor law, the defendants being the treasurer and agent of the company. It had been stated that the case would be carried to the United States Supreme Court.

The commission having in charge the conduct of the Massachusetts workmen's compensation act has decided that the fact that an employee is injured while neglecting to use a guard or other protecting device does not preclude procuring compensation, such neglect not being wilful misconduct in the meaning of the law.

Specifications for Machinery Castings

Their Use Would Result in Improved Quality, But Tests Must Be Further Developed and Higher Cost Must be Expected

BY JOHN JERMAIN PORTER

In most lines of machinery, cast iron is by far the most important material of construction. In such important classes as machine tools and engines it forms not less than 90 per cent. by weight of the finished machine, and it is probable that more than 1,500,000 tons of cast iron will go this year into the construction of machinery.

Notwithstanding this extensive use, machinery castings are ordinarily bought and made with only the haziest of concepts as to the properties necessary in the material, and with only the loosest of specifications to control the quality. It is not unusual for an order to state only the number of castings desired, and it is rare indeed that there is any effort to specify or determine quality beyond the simple statement that the castings must be true to pattern and free from blowholes and similar defects.

The Contrast Between Steel and Cast Iron

Contrast this condition with the great attention paid to steel as a material, the most careful study being given to the properties desired and their attainment. In almost every case its composition and properties have been tested at some stage of manufacture and it is usually bought on fairly complete and stringent specifications.

We do not have to go far to seek the reasons for this difference. Steel is a homogeneous material and the properties of the test piece represent with a fair degree of accuracy the properties of the structure made from the same material. Hence, the engineer can with safety design his parts according to the data secured from the test piece. Moreover, the relation of composition and method of manufacture of steel to its properties is well understood.

On the other hand, cast iron is essentially a non-homogeneous material and has the reputation of being extremely variable and untrustworthy. For this reason engineers find it necessary to allow so large a factor of safety that ordinary differences in strength are not worth considering. It is to be feared, moreover, that to many engineers and users cast iron is simply cast iron, and there is no appreciation of the great differences possible in the material.

Now, while it is true that cast iron is not like steel and cannot be expected to remain as uniform in its properties, nevertheless its bad reputation in this respect is largely a heritage of the past and need not apply to the product of the modern foundry.

Improvement of Product and Reduction of Cost

The first point to be considered is what we expect to accomplish by the use of specifications or standards of quality. Since their use presupposes definite knowledge of the properties desired in the material in many cases their greatest value is in focusing attention on this point and thus indirectly bettering the quality of the product. Assuming the properties to be desired are known, buying on specification furnishes the only sure means of getting the results desired.

When we mention specifications the average foundryman or user of cast iron thinks only of strength, and it is well known that in a large number of machinery castings strength is of relatively small importance since the parts must be designed for weight and rigidity and therefore contain an excess of metal over that required by mere considerations of strength. However, there are many other properties to be considered, such as hardness, wearing power, porosity, color, ability to take a polish, elasticity, etc., and some of these are frequently of much more importance than strength. The ability to take a polish, for example, is of very great importance to machine tool builders who as a rule pay much attention to the appearance of their product and use polished surfaces freely. One who has never investigated this matter would be surprised at the great differences in the appearance of polished castings of otherwise similar properties. Another example is the case of automobile and gas engine cylinders, which must first of all be free from porosity and secondly should have the greatest resistance to wear consistent with sufficient softness to permit machining. Enormous differences in both properties are possible in castings of equal hardness.

Although the improvement of product is thus the chief advantage to be anticipated, it may in some cases be possible to effect some reduction in the cost of manufacture by means of specifications, owing to the greater uniformity of the metal and the elimination of hard castings. As a usual thing buying on specifications means a broader field for the purchase of materials and a better price; but in this case, owing to the fact that most foundries are not prepared to furnish castings of guaranteed or known properties this advantage cannot be expected. On the contrary, a narrower field and a higher price are very apt to be the result.

Differentiating Properties of Castings

I do not propose to do anything so bold as to attempt to draw up model specifications of general applicability, but it may not be amiss if I discuss the general principles to be applied to the case of cast iron. The steps involved are: First, to decide on the properties desired; second, to determine how they shall be specified—whether directly, and if so, in what terms, or whether indirectly, by specifying composition, method of manufacture and other controlling factors; third, to provide a system of inspection and tests or other means of determining whether the specifications are being fulfilled.

The properties desired depend on the casting and its use. In most machinery parts hardness is probably the most important property, with strength and ability to take a polish following closely. In castings such as lathe and planer beds, the resistance to wear (in the vees) is of considerable importance. The case of engine cylinders has already been mentioned. In some cases stiffness is of some importance, and there are other properties which occasionally need consideration. In general, however, we have two classes of castings: First, general machinery castings in which the important properties are softness, the ability to take a good polish, and strength; second, cylinders and to a less extent lathe beds and similar castings in which close grain and resistance to wear are of prime importance, although they must be accompanied by good strength and a reasonable degree of softness.

Methods of Testing

To decide on these properties as desirable is an easy matter; to find means of specifying them is often more difficult. Such properties as strength and hardness are easily specified directly. Strength is measured by a tensile or transverse test bar, preferably cast, attached to certain castings. Hardness may be measured on the casting itself by means of the Shore scleroscope or by the drill test, on a separate test piece. There is now in existence no recognized test for resistance to wear. It should not be impossible to devise one; but as the factors influencing this property are now fairly well understood, it is perhaps more satisfactory to get the desired results by the indirect method of specifying composition and method of manufacture. The same is true as to the property of closeness of grain, ability to take a polish and freedom from porosity.

As a general proposition it is better not to hamper the manufacturer by required composition and method of manufacture but to hold him responsible for results only. However, there are some properties, such as the last mentioned above, which are so intangible as to render it very difficult if not impossible directly to measure them satisfactorily. In the case of steel also it has been found that tests of the material alone cannot satisfactorily cover

the ground, there being service differences which are not discovered by inspection or laboratory tests, but which depend upon and hence can be controlled by composition and method of manufacture.

Finally, there is the matter of a system of inspection, tests and records which will show whether specifications are being lived up to. Such a system to be successful must be simple and not involve burdensome detail or expensive features. In the average plant skilled testing engineers are not available, hence the tests must be simple enough to be made by men of average intelligence and without special training, and also without the use of excessively expensive apparatus.

In my experience I have obtained very satisfactory results by the use of only one test piece, or rather one kind of a test piece—a bar 13 in. long by 1 in. square in cross section, several of which are poured along with the casting or preferably cast attached as coupons to certain representative or important castings. If this latter plan is followed there is no possible chance for fraud or for the bars from different heats and mixtures becoming mixed up.

The Test Bar

It is well to state in this connection that the size of the test bar should bear some relation to the thickness of the castings, owing to the well-known fact that the structure and properties of cast iron are a function of rate of cooling, as well as composition and method of melting. It is not, however, necessary to have the section of bar exactly correspond with the thickness of the casting. Indeed, this is usually an impossibility, since castings are not always uniform in section. The 1-in. square bar is fairly representative of the great bulk of ordinary machinery castings. For very light work a ½-in. square bar would be preferable, while for heavy rolling mill and engine castings a 2-in. square bar would be better.

These test bars when broken on a transverse testing machine serve to determine strength, and the broken pieces can then be subjected to a drill test for hardness. The 1-in. square bar which I have advocated is slightly less accurate than the American Foundrymen's Association standard test bar, which is a 1¼-in. diameter round bar cast vertically. It is this provision of vertical casting which makes it not feasible to use this test bar for routine work. The drill test can be carried out in a number of ways, but one method which I have found advantageous, because of its ideal simplicity, is to attach a lever and weight to the hand feed of an ordinary drill press in such a way as to produce a constant pressure on the drill point. A revolution counter is also used to record the revolutions of the drill and the number of revolutions required to drill entirely through a piece of 1-in. test bar is taken as the numerical measure of hardness. Of course, it is necessary to take an average of several observations in order to get a reliable figure.

The Shore scleroscope may also be used to test hardness. It possesses the advantages that the test is quickly carried out, that it is portable and may be carried to the work, and that it can be used directly on the casting, thus eliminating the necessity of a test piece. It possesses the serious disadvantage that it measures surface hardness only and at a very minute area of the surface. This is not objectionable in the case of a homogeneous material like steel, but in the case of a non-homogeneous material like cast iron the indications of this instrument are very uncertain. The instrument is also less sensitive on cast iron than is desirable.

In my opinion these are the only tests ordinarily necessary and desirable, but in addition I would specify limits of composition, the presence of special elements in some cases, and the use of steel scrap (semi steel) for some work.

The Commercial Side of the Question

Although it is evident that cast iron does not lend itself as readily as steel to specifications, still from a technical standpoint there are important advantages in purchasing on this basis. Commercial feasibility, however, is another thing, and as I see it there are three objections to any attempt to change the existing method of purchase.

In the first place, is the difficulty in formulating satisfactory specifications. This is a matter which calls not only for an intimate knowledge of foundry practice and of the chemistry and properties of cast iron, but also an equally intimate knowledge of commercial conditions, together with good business judgment. It is not every builder of machine tools or other machinery that possesses this knowledge within its organization, and if obtained outside the cost is a factor to be reckoned.

Second, is the difficulty in getting foundries to bid on specifications. Foundry progress has been slow, because the business could be carried on in a small way, and until recently there has been no great economy in large plants. Indeed, this latter condition still holds true for foundries doing jobbing work. Small plants, on account of the necessity of keeping down overhead charges, cannot command a high grade of technical skill. Within recent years great progress has been made both in mechanical equipment of the foundry and in the technical knowledge of cast iron. This progress has been so widely exploited through the technical press that we are likely to think of the industry as completely emancipated from the thralldom of ignorance and old-fashioned methods. This, however, is not the case; the up-to-date foundries are still in the minority and small plants operated along old-fashioned lines are still in the majority, especially among the jobbing foundries.

Because of these conditions, there is apt to be more or less trouble in getting foundries to bid on specifications, and a restricted number of bidders makes for higher prices. A foundry to handle such work successfully would have to employ a chemist and have facilities for testing. It should have these anyway, but few do have, and those that do often feel entitled to a higher price for putting on these "frills." This general condition is probably the greatest obstacle to any attempt to buy castings on specifications. It is not an insurmountable obstacle, however, for the writer knows of a number of cases where gray iron castings are successfully bought on specifications, including both composition and strength. It is fair to say that in some of these cases, at least, higher than market prices are the result.

The third difficulty is the trouble of operating specifications and the cost of making the necessary tests and inspections. To some shops these difficulties are negligible and to others so great as to practically forbid the use of specifications. It depends largely on the organization available. While the amount of testing required is small, the cost will still be considerable if it is done in an outside laboratory. If done within the plant the cost will be small; but to be successful it must be in the hands of the right kind of a man who has a reasonable amount of interest in the work. Moreover, the results of the tests must be carefully followed up or they are of no use.

Summary

The following conclusions summarize the preceding discussion:

1. It is technically possible to secure cast iron of special properties and castings which are much better adapted to their use than is generally the case.

2. In attempting to get an improved quality of castings by means of specifications it is essential to have competent advice as to what it is reasonable to expect in cast iron and how it is possible to obtain the desired properties.

3. An attempt to buy on specification at the present time is likely to result in an increase in the cost of the castings.

4. No exaggerated idea of the benefits to be derived should be entertained. These benefits are mainly indirect and are such as result from the more exact and definite knowledge of the material used. They will show chiefly in an improved quality of the product.

5. Specifications are only a tool, and like other tools, are useless unless there is a directing brain and guiding hand back of them.

6. The management of any shop which aims to operate according to the principles of scientific management should have definite standards of quality for the castings used, and such knowledge of the castings as is only obtained by a regular system of testing. There are many cases where actual purchase on specification is not warranted by commercial conditions, but where considerable improvement in quality can nevertheless be obtained if the properties desired are definitely known and sought and there is definite knowledge of the quality.

Rapid Determination of Carbon in Steel

A Combustion Method That Cuts in Two the Usual Time by Providing Rapid Flow of Oxygen

BY WILLIAM R. FLEMING*

The method described here has been in daily use for about a year in the laboratory with which the writer is connected. The chemical principles involved are not new. The method differs only in manipulation from the ordinary direct combustion methods in general use. Since it represents a saving in time of more than 50 per cent. as compared with the latter, and several chemists have asked the writer for a description, it has been thought worth while to publish it.

While the direct combustion method is far superior to the old solution method in ease of manipulation and in saving of time, it has its shortcomings. It is not absolutely reliable, for the sole reason that the steel does not always completely burn. Incomplete combustion is liable to occur at any time, although, fortunately, with proper drillings, this seldom happens. The combustion is more liable to be incomplete if turnings from a lathe or thick chubby drillings from a diamond pointed drill are used. Curly drillings, not too thick, from a well sharpened twist drill are by far the most reliable; in fact, the writer has never obtained low results due to incomplete combustion from this class of drillings.

Johnson, in his excellent little book, "Chemical Analysis of Special Steels, etc.,", says that the combustion proper requires about 13 minutes. By "combustion proper" is meant the burning of the steel and transfer of carbon dioxide to the weighing apparatus. According to Johnson, 2 g. of steel require three minutes to burn, and the transfer of carbon dioxide to the weighing apparatus requires 10 minutes. So far as the writer is aware, the combustion proper is completed in not less than 12 minutes by any steel laboratory in this country.

In this laboratory the combustion proper never requires more than six minutes, in most cases only five. The results obtained are as accurate as those obtained by following the method as outlined in Blair, Johnson, or other books on steel analysis.

The Apparatus and Reagents

The combustion train is shown in the accompanying figure, which is self-explanatory. Any of the ordinary trains, of course, can be used. The mercury pressure gauge A is necessary to follow properly the course of the combustion. The most important apparatus, however, is the absorption tube, W. While the form of apparatus shown may not be necessary, a *large diameter* tube containing soda lime must be used, and the soda lime must be protected by phosphoric anhydride. No other combination of reagents can be used to absorb the carbon dioxide in this rapid method. In fact, this form of apparatus and these reagents are the most efficient and reliable for the absorption of carbon dioxide in any method. It is infinitely superior to potash solution protected by potassium hydroxide or anything else.

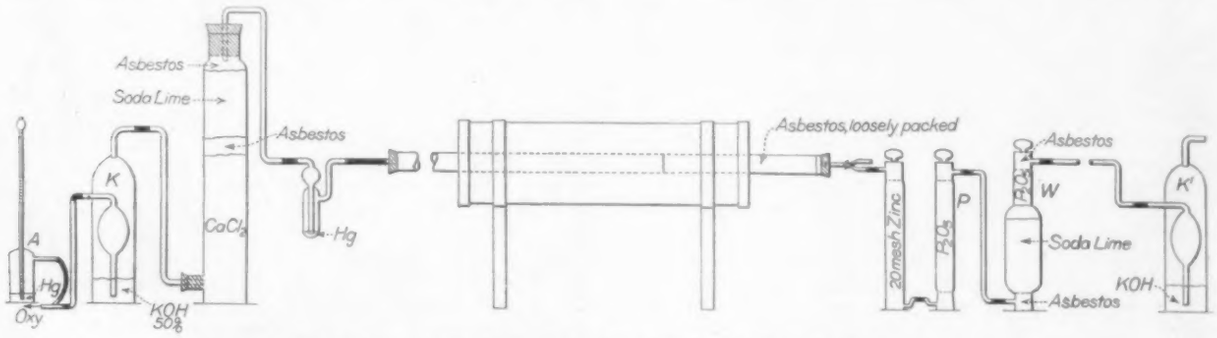
On account of the violent combustion of the steel in this rapid method, as little sample as is consistent with good results is used. If the steel contains over 0.40 per cent. of carbon, 1½ g. are used; if below 0.40 per cent. 2 g.

Before starting a determination the ground glass stopper in the top of P is closed, and the oxygen is turned on until the mercury in A shows a pressure of about 4 in. After connecting the weighing apparatus, the stopper in P and the bottom and top stoppers in the weighing apparatus are opened in the order named. A rapid stream of oxygen sweeps the ordinary air from the glass tubing beyond the absorption tube. This glass tubing is ⅛ in. bore (at least 1 ft. long) and answers just as well as a guard tube containing calcium chloride or soda lime. The potash bottle at the end of the train is used only to satisfy one's curiosity to know whether the oxygen is flowing through the train. In fact, both potash bottles shown in the figure are absolutely unnecessary as absorbents of carbon dioxide, each being used to indicate the flow of gas.

Combustion Procedure

Thin curly drillings are spread out the entire length of a clay boat 3 in. long. The boat is quickly pushed into the combustion tube and the oxygen turned on rapidly until the mercury shows a pressure of several inches (which depends on the resistance of the train to the passage of the gas). A pressure of 4 in. in the train as made up in this laboratory usually gives a current of 400 cc per minute. Twenty or 30 seconds after the boat is pushed into the furnace the column of mercury will begin to recede, which marks the beginning of combustion. The flow of oxygen is immediately increased so that it continues to leave the exit end of the train at the same rate it escaped before combustion began; namely, about 300 to 400 cc per minute. In 30 seconds 1½ g. of steel will burn completely and 2 g. in 45 seconds. As a rule the steel is completely burned one minute after being placed in the combustion tube. The end of combustion is noted by the rapid rise of the column of mercury. The flow of oxygen (400 cc per minute) is continued for four more minutes. The two-way stop following the combustion tube is closed immediately after shutting the oxygen valve. Then close the top stopper in P and the bottom and top stoppers in W in the order named. Disconnect W, open the lower stopper to relieve the excess pressure, and weigh immediately. A duplicate apparatus is used as a tare and is kept constantly at the side of the weighing apparatus whether in the combustion or balance room. If proper care is taken there is no necessity of ever waiting before weighing. After weighing, note the column of mercury in A. If it has receded, incomplete combustion may be suspected. A minute's observation will decide this point. While incomplete combustion never occurs with thin curly drillings, it is rather frequent with turnings or drillings from a diamond pointed drill, even though the latter were sieved through a 20-mesh screen.

The weighing apparatus is filled as shown in the figure. Baker's 12-mesh soda lime is used, the dust which passes



Apparatus Employed in the Rapid Determination of Carbon in Steel by Combustion

*Laboratory Andrews Steel Company, Newport, Ky.

-mesh sieve being discarded. This, protected by phos-ric anhydride, makes the most efficient absorbent for rbon dioxide known. Oxygen containing carbon dioxide n be rushed through the apparatus used by the writer at tremendous rate of 1000 cc per minute without it losing slightest quantity of carbon dioxide or moisture. Coarse da lime must not be used. Phosphoric anhydride is the only known drying agent that will trap all moisture swept from the soda lime when the oxygen is passing through the apparatus at the rate of 600 cc per minute.

Accuracy with Rapid Flow of Oxygen

The unusual feature of the method just described is the tremendous rate at which the oxygen is made to flow through the train. This is made possible only by the use of a specially constructed absorption apparatus containing soda lime protected by phosphoric anhydride. Most chemists are of the opinion that oxygen cannot be rushed through the apparatus as is done in this method and accurate results obtained. Johnson says that if the oxygen is rushed through the absorption apparatus during the combustion period low results are often obtained, due "probably" to carbon monoxide escaping from the hot part of the tube before it has had time to oxidize. Mr. Johnson must have assumed this to be the case because he offered no proof that carbon monoxide actually did escape. Consistent daily results obtained by the method just described are ample proof that Johnson's statement is inaccurate. However, to disprove the statement directly the following experiment was carried out:

Ten combustions were run on a standard steel containing 1.025 per cent. of carbon. In each combustion 1½ g. of steel was used and in every case the steel was burned in 30 seconds. The oxygen during the combustion period was leaving the train at the rate of 400 cc per minute. After leaving the first absorption apparatus the gases were conducted through a second tube (porcelain ¼ in bore) filled with copper oxide and heated to 960 deg. in a second electric furnace. Immediately following this was placed a second weighing apparatus which was not disconnected to weigh until the entire 10 combustions had been run. The following table shows the results in detail:

Time in comb. tube before combustion started.	Time required for complete burning of steel.	Total time of combustion proper.	Temp. of furnace.	Gain in weight of second weighing apparatus.	Per cent. of carbon found.
45 sec.	60 sec.	6 min.	950 deg.		1.025
45 sec.	45 sec.	6 min.	950 deg.		1.023
30 sec.	45 sec.	6 min.	970 deg.		1.025
30 sec.	30 sec.	5 min.	970 deg.		1.018
30 sec.	30 sec.	5 min.	970 deg.		1.028
30 sec.	30 sec.	6 min.	970 deg.		1.027
30 sec.	30 sec.	5 min.	970 deg.		1.025
30 sec.	30 sec.	5 min.	970 deg.		1.025
30 sec.	30 sec.	5 min.	970 deg.		1.020
30 sec.	30 sec.	5 min.	970 deg.	0.0010 g.*	1.034

*Entire gain for ten combustions.

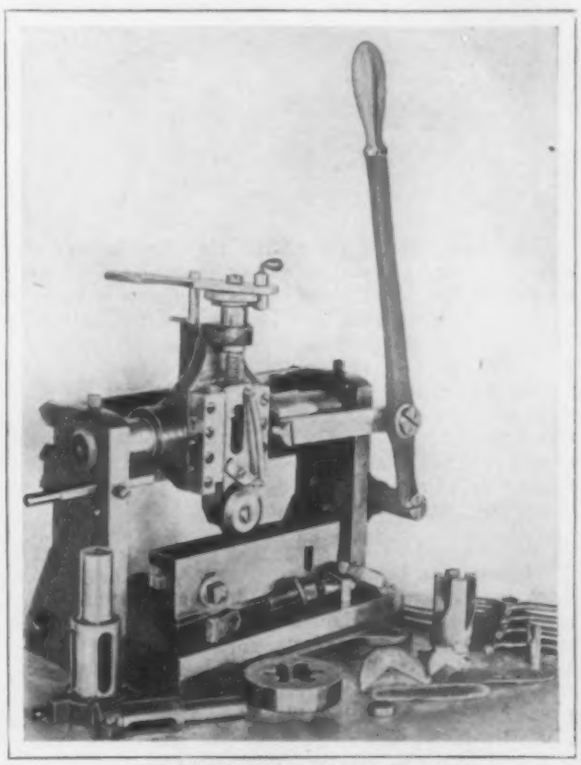
The above table not only shows that there is no possibility of carbon monoxide escaping unburned, but that excellent duplicate analyses can be obtained by this extremely rapid method. The minute gain in weight of the second weighing apparatus was not due to absorption of carbon dioxide. This was demonstrated by running a second set of ten combustions in which a phosphoric anhydride tube was placed between the second combustion tube and the second weighing apparatus. In this case the second weighing apparatus gained nothing, showing that oxygen can be rushed through the absorption apparatus during the combustion period at the enormous rate of 400 cc per minute and not the slightest trace of carbon monoxide escape unoxidized.

Since the burning steel spatters more than in the ordinary method a platinum cylinder should be used to protect the combustion tube. Otherwise the tube should be taken out of the furnace frequently and the clinging oxide removed by tapping lightly with a stiff steel rod.

A word of caution must be added concerning the use of clay combustion boats. Many clays are unfit for use because during combustion of the steel they give up carbon dioxide which is not liberated by preparatory heating. Such clays can be burned for several hours at 1000 deg. in an atmosphere of oxygen; yet when used for a combustion they give high results—in some cases extremely high. This is, perhaps, due to the violent heat generated during combustion and to the slagging of the steel with the boat, thus liberating carbon dioxide which was not expelled by preliminary heating. A good clay, free from difficultly decomposed carbonates, mixed with an equal part of alundum, makes the most satisfactory boats. If a good clay can be found, the clay boat is by far the best and the most economical to use. No sand, alundum, or anything else need be used to protect the boats in this rapid method, because they do not protect. A new boat is used for each combustion.

The Hjorth Marking Machine

The marking machine illustrated below, manufactured by the Hjorth Lathe & Tool Company, 27 School Street, Boston, Mass., is designed to make straight and flat work in metal with trade marks, patent dates or other designations. Its capacity is 3½ x 10½ in. Circular



The Hjorth Metal Marking Machine

stamps for flat work are spring operated, the stamp returning to its original position ready for the next piece when the lever is released. A positive stop regulates the horizontal movement. The head is provided with means to compensate for varying thicknesses of stock and adjustments may be made for both straight and taper work. The spindle is 1⅜ in. diameter, which is sufficient to resist the most severe strains that can be imposed upon the machine. The net weight is 61 lb.

Foundrymen's Conventions at Chicago in 1913

Representatives of the Foundry & Machine Exhibition Company, the American Foundrymen's Association and the American Institute of Metals, had a meeting recently and decided to hold the 1913 conventions of these organizations in Chicago in the week of September 29. This decision indicates a preference for fall meetings, in view of the experience at Buffalo last year, the convention there having been postponed from May, the customary time, to September. It is probable that the plan adopted at Buffalo will be followed again of having the exhibition of foundry machinery and appliances in a large hall, while the meetings of the American Foundrymen's Association and the American Institute of Metals will be held at hotels which have not yet been designated.

A Complete Milling Machine Test

A British Manufacturer Makes an Analysis of Strength and Efficiency—Weakness Developed and Remedied—Design of Cutting Tools

In a paper read before the Manchester Association of Engineers, Manchester, England, P. B. Vernon gives a detailed account of a series of experiments carried out on a heavy type of horizontal milling machine with single pulley drive, which was built solely for experimental purposes by Alfred Herbert, Ltd., Coventry, England. The purpose was to produce the best possible machine, test it thoroughly and then modify or redesign such parts as might not work satisfactorily. The specifications of the machine follow:

Longitudinal feed	42 in.
Transverse feed	13½ in.
Vertical feed	21 in.
Working surface of table	68 in. × 17 in.
No. of tee slots in table	3
Width of tee slots in table	¾ in.
Diameter of single pulley	16 in.
Width of belt	5 in.
Speed of single pulley	400 r.p.m.
Belt speed in feet per minute	1675
Maximum gear ratio	24.4 to 1
Taper hole in spindle	No. 12 B. & S.
Number of speeds	16
Range of speeds	16.4 to 427
Number of feeds	18
Range of feeds in inches per minute	⅛ in. to 22½ in.
Weight	8 O 52 lb.

The motor specially installed for experimental work was of 220 volts, direct-current, compound-wound, interpole type, with 3 to 1 speed variation, giving 30 brake hp. at all speeds on normal full load, with a guaranteed and tested overload capacity of 75 per cent. for one minute, 33 1/3 per cent. for 15 minutes, and 20 per cent. for two hours. The speeds of the motor ranged from 320 to 960 turns per minute in 30 steps and the motor could be reversed when required. The connection between the motor and the machine was by a double leather belt 5 in. wide, with a scarfed and cemented joint. The motor pulley was 16 in. diameter, the same as that of the machine.

The Initial Tests

The machine, being of new design throughout and very much more powerful than any previously constructed, it was expected that certain defects would manifest themselves when taking heavy cuts, so that before making systematic power tests it was decided to take some preliminary cuts of a more or less destructive nature with the object of taking the measure of the machine and of discovering and removing any weaknesses at the earliest possible stage, so as to ensure continuous running during the power tests. The first cuts were therefore taken on a cast iron test block 5 in. wide, using a 3-in. coarse pitch spiral cutter made of high-speed steel mounted on a 1¼-in. arbor and running at various speeds.

The greatest output was obtained running at 93 turns per minute (73 ft. per minute), with a depth of cut of 625 in. and a feed of 11 3/16 in. per minute. This gave a maximum production of 34.96 cu. in. of metal removed per minute, but the arbor was eventually twisted, and, of course, put out of action. The next cuts were taken with a 3½-in. cutter 9 in. long on a 1½-in. arbor, with a test block 8 in. wide. In this case the maximum output was reached at 75 turns per minute (70 ft. per minute), with a depth of cut of 4 in. and a feed of 12⅞ in. per minute. For these cuts the arbor stood very well and the output reached 44.4 cu. in. per minute. The results of these preliminary tests with the 3½-in. cutter, which were made on cast iron only, are shown by Table 1.

It was not certain that this cutter had exhausted the power of the machine, so it was decided to make further tests with a 4½-in. cutter 9 in. long of coarse pitch, mounted on a 2-in. arbor, which gave ample strength and stiffness. A few preliminary tests were made with this cutter and arbor running at various speeds, with the result that the next thing to fail was the main spindle of

TABLE 1.

3½-in. High Speed Cutter, 8 Teeth, 1½-in. Hole. Milling Cast Iron Block 8 in. Wide at 75 Turns—70 ft. per Minute.

Depth of cut, inches.	Feed measured, ft. per min.	Net H.P.	Metal removed— Cubic in. per min.	Metal removed— Cubic in. per H.P. min.
0.24	21	27.3	40.32	1.47
0.25	21 3/16	23.7	42.40	1.78
0.26	17	24.9	35.84	1.44
0.28	17 1/16	30.8	38.21	1.24
0.30	16 11/16	30.8	40.04	1.31
0.32	13 11/16	27.3	35.04	1.28
0.34	13 7/8	26.1	37.73	1.44
0.36	13 7/8	30.8	39.96	1.29
0.375	13 11/16	29.6	41.06	1.38
0.40	13 7/8	33.3	44.40	1.33
0.42	11 5/8	30.8	39.06	1.26
0.44	10 15/16	23.7	38.50	1.62
0.46	9 3/16	28.6	33.81	1.18
0.48	9 1/4	27.3	35.52	1.30
0.50	9 1/8	24.9	36.50	1.46
0.55	9 1/8	29.6	40.15	1.35
0.60	7 5/16	30.8	35.04	1.14
0.625	7 7/16	27.3	37.18	1.36
0.70	7 3/16	29.6	39.75	1.32
0.75	5 15/16	28.6	35.62	1.25
0.80	5 15/16	30.8	38.00	1.23
0.85	4 9/16	29.6	31.02	1.04
0.90	4 13/16	28.6	34.56	1.20
0.95	3 15/16	26.1	29.92	1.14
1.	3 15/16	29.6	31.50	1.06
1.05	3 1/4	24.9	27.30	1.09
1.1	3 1/4	26.1	28.60	1.09

the machine, the rectangular box clutch nose by which the arbor was driven being badly distorted. The spindle was of heat-treated Siemens-Martin steel of 48 tons maximum stress and 32 tons yield point, but was not hardened, as up to the time of failure of the nose it had been considered that the greater strength of this material rendered it more suitable than the weaker variety of steel that would have had to be used if case-hardened. This was found to be incorrect. After the failure of the box clutch it was decided to try a hardened spindle, but before doing so to use the existing spindle to test the vertical milling attachment which was next put in position. A number of cuts were taken with the vertical milling attachment over the same test block, using a high-speed steel inserted tooth face cutter 9 in. in diameter, screwed upon the nose of the vertical spindle, which was identical with that of the main

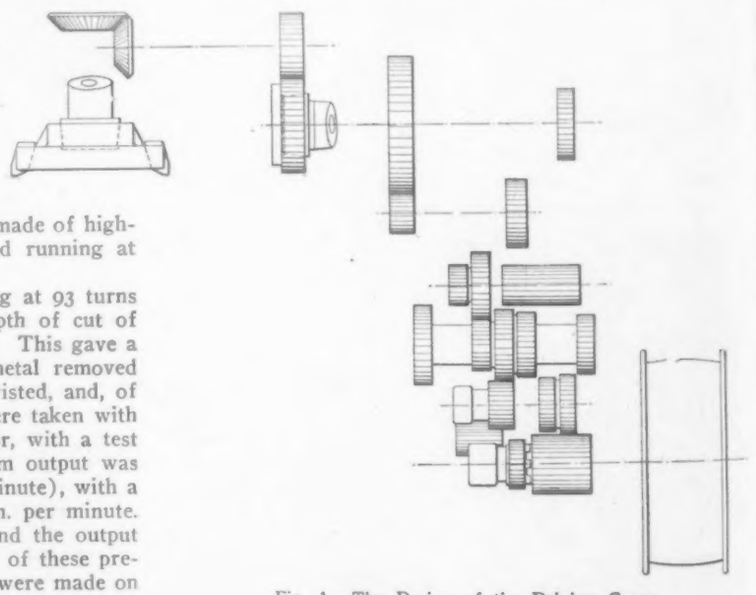


Fig. 1.—The Design of the Driving Gears

spindle of the machine. The spindle noses as first made are shown by Fig. 5, the diameter being 4 3/16 in. and the thread quintuple, the pitch being 1 2/3 in.

The face cutter was of the design shown in Fig. 3, except that it was threaded for attachment to the spindle nose. The vertical spindle was driven by spur and bevel

gears made of heat-treated 48-ton steel, the first gear being screwed upon the main spindle nose in the same way as the face cutter. Fig. 2 is a diagram of the gear train for driving the vertical spindle.

A Test of Greatest Severity

The result of these tests was that all the gears of the vertical attachment were ruined, the teeth being bent badly out of shape, although none were actually broken. It was also found to be impossible to remove either the face cutter or the gear from their respective spindles in spite of the quick pitch thread. Evidently either both spindles or one spindle and the cutter had to be sacrificed, and as the cutter could be used on a less powerful machine, whereas both spindles were already proved to be wrong in design for heavy work, it was decided to save the cutter and to make two new spindles. Up to this point the experiments had shown that unhardened gears and the unhardened box clutch were unsuccessful, and that the screwed spindle nose was also a failure. The new gears and spindles were made of a good quality of case-hardening steel, which was carefully heat-treated and hardened. The rectangular box clutch was retained, but was, of course, hardened. The screwed nose was abolished and a plain taper nose adopted, the design of which is shown by Fig. 6. The new design of spindle nose had a further important advantage over the screwed nose in that it could be used equally well with the spindle running in either direction.

The diameter of the spindle itself was 3¼ in. at the large end of the front conical bearing, and 3⅜ in. at the seat—just behind the bearing—on which the large driving gear was keyed, and it is interesting to note that there was no trouble whatever caused by chatter or torsional vibration, even on the heaviest cuts. The new face cutter was made to fit the taper nose, and was provided with a driving portion shaped to fit into the box clutch, the cutter being held on the spindle by a draw bolt passing through it from end to end. Fig. 3 shows the face cutter as finally employed. This design proved to be perfectly satisfactory under the heaviest cuts that could be taken, absorbing as much as 42 hp.

While the new gears and spindles were being made the machine was dismantled for examination, and it was found that the pinion A, Fig. 1, had failed, the teeth being badly distorted. This pinion, which was in one piece with its shaft, was made of 48-ton steel, and was the only unhardened gear in the whole train. A case-hardened pinion was substituted for it and all trouble ceased, apparently forever, for at the end of the whole series of tests the hardened gears showed no signs of wear or of distress, and were in as good condition as when first put into the machine.

Although no failure of the feed motion had occurred during these rather severe tests, yet the speed of the feed-box had appeared to be excessive, causing considerable rattle when the feed was changed, and it was therefore decided to reduce the speed by one-third by enlarging the driven feed pulley before beginning the final tests. The ratio of the gears by which the motion was transmitted from the feed-box to the knee was altered at the same time so as to preserve the original range of feeds. The operating hand wheel for changing the feeds was also arranged to be interlocked with the starting lever of the machine, so as to prevent all chance of damage by the feed being changed while the machine was cutting.

Minor Defects Revealed

Further examination of the machine at this stage showed that the phosphor-bronze bearing supporting the feed pulleys had worn considerably, and ball bearings were substituted for them with satisfactory results. Other defects came to light during the preliminary tests, such as lubrication troubles, difficulties of manufacture, erection, etc., and alterations were freely made to remedy them; but the incidents described have been selected for description in order to show the kind of defects which are discovered by experimental work of this nature, and in themselves form ample justification for the time, trouble and expense involved in making the tests.

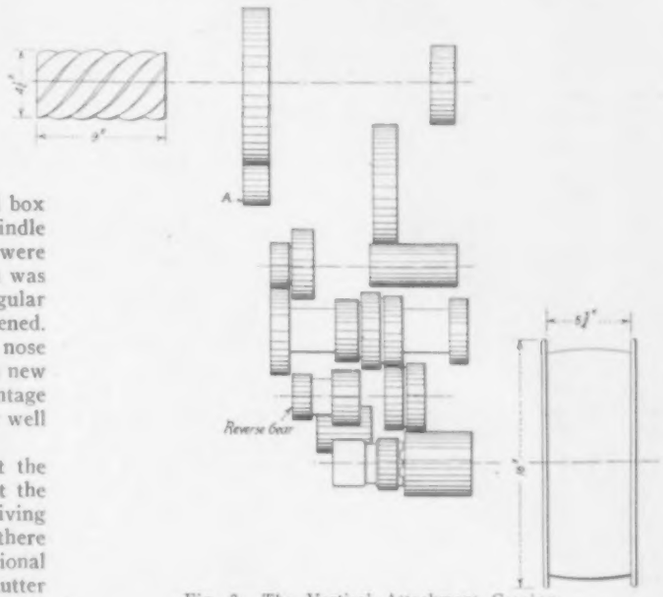


Fig. 2.—The Vertical Attachment Gearing

TABLE 2.

4½-in. High Speed Cutter, 10 Teeth, 2-in. Hole. Milling Cast Iron Block 8 in. Wide at 60 Turns—70 ft. per Minute.

Depth of cut, inches.	Feed measured, ft. per min.	Net H.P.	Metal removed— Cubic in. per min.	Cubic in. per H.P. min.
0.24	17 5/8	20.3	33.80	1.66
0.24	17 1/2	23.0	35.00	1.52
0.26	17 3/8	26.1	36.15	1.38
0.28	17 3/16	34.6	38.52	1.11
0.30	13 7/8	23.7	33.30	1.40
0.32	13 1/4	29.6	33.92	1.15
0.34	11 5/8	24.9	31.55	1.27
0.36	11 1/2	27.3	33.12	1.21
0.375	13 1/2	22.8	40.50	1.77
0.40	11 3/16	27.3	35.84	1.32
0.42	11 3/8	26.1	38.22	1.46
0.44	9 1/8	23.7	32.12	1.35
0.46	9 1/16	24.9	33.34	1.32
0.48	9 3/16	27.2	35.33	1.29
0.50	9 1/4	30.8	37.00	1.20
0.55	7 1/2	28.6	33.00	1.15
0.60	6 3/16	27.3	29.76	1.25
0.625	9 3/16	24.9	45.93	1.84
0.650	9 1/4	30.8	48.10	1.56
0.70	7 7/16	35.1	41.60	1.19
0.75	6 3/16	38.6	38.80	1.35
0.80	6 1/16	29.6	38.79	1.31
0.85	4 7/8	27.3	33.15	1.21
0.90	4 15/16	29.6	35.54	1.20
0.95	4 3/4	35.1	36.10	1.03
1.	4	27.3	32.00	1.17
1.05	3 7/8	37.1	32.54	.86
1.1	3 5/16	28.6	29.04	1.02

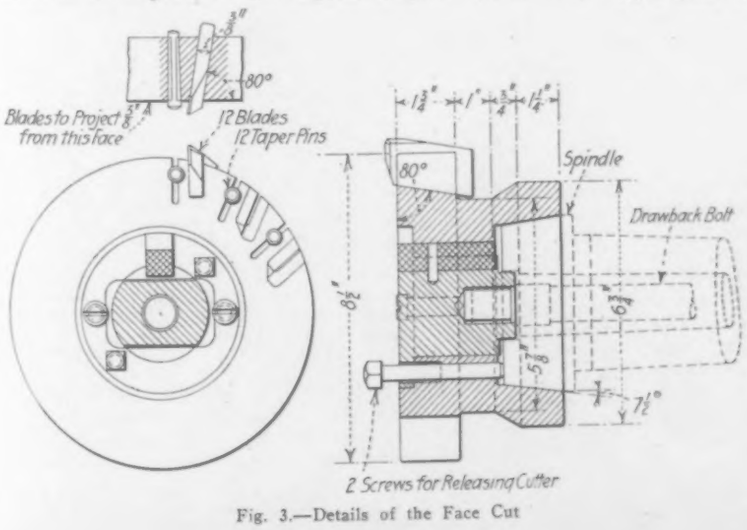
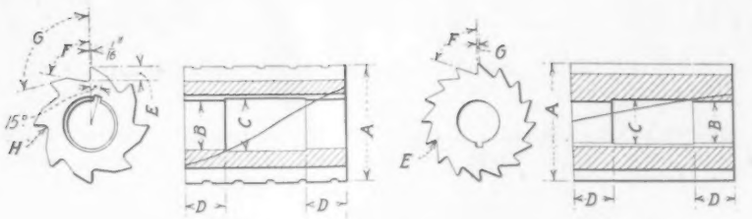


Fig. 3.—Details of the Face Cut

The cutter finally used in the recorded tests was 4½ in. diameter, 9 in. long, made of high-speed steel. It had ten teeth and the angle of spiral was 26¼ deg. The diameter of the arbor was 2 in. Fig. 4 gives particulars of a range of such cutters suitable for heavy roughing work, and also of the corresponding fine pitch cutters used for light milling. The test blocks, made of cast iron and mild steel, were 8 in. wide and 2 ft. 4 in. long.



Coarse Pitch											Fine Pitch									
Diam of Cutter A	B	C	D	E	F	G	H	J	Keyway	No. of Teeth	Diam of Cutter A	B	C	D	E	F	G	Keyway	No. of Teeth
2½	1	1/16	1/4	3/8	80°	103°	1/8 r	26½	5/32×3/32	8	2½	1	1/16	1/4	3/64 r	70°	3/64	5/32×3/32	14
3	1¼	1 5/16	1/4	3/8	80°	103°	1/8 r	26¾	3/16×1/8	8	3	1¼	1 5/16	1/4	3/64 r	70°	3/64	3/16×1/8	14
3½	1½	1 9/16	1/4	7/16	80°	103°	1/8 r	27	1/4×5/32	8	3½	1½	1 5/8	1/4	3/64 r	70°	3/64	3/16×1/8	16
4	1¾	1 13/16	1/4	7/16	71°	94°	3/16 r	25½	1/4×5/32	10	4	1½	1 13/16	1/4	1/16 r	65°	1/16	1/4×5/32	18
4½	2	2 1/16	1/4	1/2	71°	94°	3/16 r	26¾	5/16×3/16	10	4½	1½	1 13/16	1/4	1/16 r	65°	1/16	1/4×5/32	20

Fig. 4.—Details of Cutters for Heavy Roughing Work

TABLE 3.

4½-in. High Speed Cutter, 10 Teeth, 2-in. Hole. Milling Mild Steel Block 8 in. Wide at 60 Turns—70 ft. per Minute.

Depth of cut, inches.	Feed measured, ft. per min.	Net H.P.	Metal removed—Cubic in. per min.	Metal removed—Cubic in. per H.P. min.
0.24	11 3/8	30.8	21.84	0.71
0.25	10 7/8	29.6	21.75	0.73
0.26	11 1/8	39.8	23.14	0.58
0.28	9 1/8	28.6	20.44	0.71
0.30	9 1/32	29.6	21.67	0.73
0.32	8 7/8	30.8	22.72	0.74
0.34	8 15/16	42.1	24.31	0.58
0.36	7 5/16	30.8	21.06	0.68
0.375	7 1/8	28.6	21.37	0.74
0.38	6 3/4	30.8	20.52	0.67
0.40	6 1/16	27.3	19.40	0.71
0.42	6	29.6	20.16	0.68
0.44	5	24.9	17.60	0.71
0.46	5	27.3	18.40	0.67
0.48	4 15/16	28.6	18.96	0.66
0.50	4 15/16	30.1	19.75	0.66
0.55	4 7/8	30.8	21.45	0.69
0.60	4 13/16	37.1	23.10	0.62
0.625	3 15/16	29.0	19.68	0.68
0.70	3 15/16	30.8	22.05	0.71
0.75	3 1/4	28.6	19.50	0.68
0.80	3 1/4	32.0	20.80	0.65
0.85	2 5/8	26.1	17.85	0.68
0.90	2 9/16	30.8	18.45	0.60
0.95	2 1/8	24.9	16.15	0.65
1.	2 1/8	29.6	17.00	0.57
1.05	2 1/16	24.9	17.32	0.69
1.1	2 1/16	28.6	18.15	0.64

As a result of the preliminary experiments, it was decided to run the cutter at a speed of 60 turns per minute, equal to just over 70 ft. per minute, for all the tests on both cast iron and mild steel. The method adopted for making the tests was to begin with the quickest feed provided by the machine and to take a series of trial cuts until the deepest cut possible was reached, rejecting any cut that caused the belt to slip, or that seemed to be in any other way too much for the machine. The next lower feed was then taken and the depth of cut further increased, and so on until the maximum safe depth of cut possible with each feed was reached. The cutter was carefully watched to determine when it required to be re-sharpened, which was only twice during the cast iron tests, and not at all during the mild steel tests.

Table 2 shows the results of the tests on cast iron, using the 4½-in. cutter, and table 3 the corresponding results on mild steel.

As a result of the series of tests certain broad generalizations can be made, such as: (1) A 5-in. double belt driving a 16-in. pulley at a speed of 400 per minute (100.531 sq. in. of belt per minute) geared to drive a 4½-in. cutter at 70 ft. per minute is able to remove as much as 48.1 cu. in. of cast iron and 24.31 cu. in. of mild steel in a minute. (2) 2090 sq. in. of double belt passing over a pulley in a minute will remove one cu. in. of cast iron on a milling machine. (3) 4135 sq. in. of double belt passing over a pulley in a minute will remove one cu. in. of mild steel on a milling machine. (4) A 4½-in. cutter on a 2-in. arbor running at 70 ft. per minute is capable of removing at least 3.63, and possibly as much as 6.01 cu. in of cast iron, and at least 2.125, and possibly as much as 3.03 cu. in. of mild steel per minute for each inch of width up to 8 in., and at any depth of cut from .24 in. up to 1.1 in. These figures are taken from the maximum and minimum outputs of the various test cuts and should be reliable for comparison, if the machine on which the work is done is reasonably efficient and has enough power and strength.

Naval Construction Costs

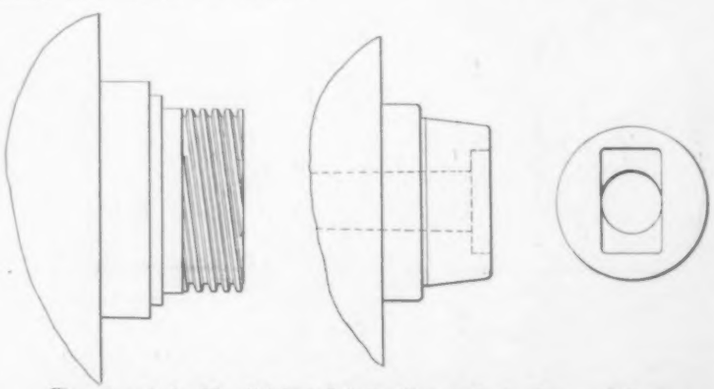
The annual report of R. M. Watt, chief constructor of the United States navy and chief of the Bureau of Construction and Repair of the Navy Department, makes an estimate of $15,609,091 under the heading of "increase of the navy, construction and machinery, for the fiscal year 1914," but this does not include any provision for such new vessels as may hereafter be authorized by Congress. Commenting on the eight-hour law, the report says:

"The three battleships Texas, Nevada and Oklahoma, at present under contract, are building under the eight-hour law. The average price per ton of normal displacement of the three vessels in question, building under the eight-hour law, is $215.26. The average price of the preceding battleships built by contract when the hours of labor were unrestricted was $177.25 per ton of normal displacement for the three preceding and $189.99 per ton for the five preceding vessels. The appropriation act approved August 22, 1912, applies the eight-hour law to all new construction authorized therein by the following language: The act entitled 'An act limiting the hours of daily service of laborers and mechanics employed upon work done for the United States, or for any territory or for the District of Columbia, and for other purposes,' approved June 19, 1912, shall be in force as to all contracts authorized by this act from and after the passage of this act."

On the rapidity of construction in this and foreign countries, the report says that "the rapidity of construction in the United States, both for battleships and destroyers recently completed without restriction as to hours of labor, coninues greater than the average rate of construction in the principal foreign shipbuilding countries. The effect of the eight-hour law upon rapidity of construction is as yet indeterminate."

The mineral output of the Nova Scotia Steel & Coal Company, Ltd., New Glasgow, Nova Scotia, in 1912 is estimated at 855,000 tons of coal at Sydney Mines and 560,000 tons of iron ore from its mines at Wabana, Newfoundland. All departments of the company's works at Sydney Mines, consisting of blast furnace and open-hearth steel works, also its Ferrona furnace and its New Glasgow rolling mills, were operated in full, though owing to competition from the United States the results in profit were not satisfactory.

The J. W. Paxson Company, Philadelphia, Pa., manufacturer of foundry equipment and supplies, held its annual exhibition of foundry appliances December 26, 27, 30, 31, when, in addition to showing the latest type of foundry equipment, lantern slide views of the Panama Canal entertained the visitors.



Figs. 5 and 6.—The Original Spindle Nose and the Improved Type

Industrial Expansion in the Cleveland District

Important Additions to Iron and Metal Working Industries in 1912 —New Ore Handling Equipment

Great strides in the growth of manufacture in metal working lines were made in Cleveland in the year 1912, materially increasing that city's importance as an industrial center. No city in the country has a greater variety of such operations, from the smelting of iron ore to the production of a multitude of finished forms, and the city's development in the year was in practically all of these lines. Many manufacturers added greatly to their capacity; new plants making similar products sprang up, and still others were started up to bring out products not previously manufactured in that city.

Situated in the heart of a great consuming territory, with access to both eastern and western markets, with unexcelled water and rail transportation facilities, with raw materials easily reached, with low-priced fuel from near-by Ohio coal fields and an abundance of cheap natural gas from West Virginia, the city has continued to forge ahead and there is nothing to indicate that its industrial growth in 1913 will not exceed that of 1912. When the last census gave Cleveland a population of 560,000, making it the sixth city, the prediction was made that the next census would show a population not far from 1,000,000. The rapid increase in the past two years, due largely to manufacturing growth, is now causing the prediction by the more sanguine that 1,000,000 population will be reached before 1920.

Keeping pace with Cleveland's growth are thriving manufacturing cities in the surrounding territory, some of which have had unusual prosperity in 1912. In these cities many new metal working plants were established and others which were taxed beyond their capacities made extensive additions.

Two important steel plant projects were brought forward in Cleveland in the year which will give the city a more commanding position in the steel industry—those of Corrigan, McKinney & Co. and the Otis Steel Company, which are referred to elsewhere in connection with a resume of the country's iron and steel works construction in the past year. The Upson Nut Company made improvements in the year which are referred to in the same connection.

Important New Ore Handling Equipment

Two additions were made in 1912 to the immense plants that have sprung up along the south shore of Lake Erie in recent years for the handling of Lake Superior ore. Early in the year the Pennsylvania Railroad put in operation an ore-handling plant in Cleveland larger in capacity than any previously erected on Lake Erie. It consists of four 17-ton Hulett unloaders and a 15-ton ore bridge; the unloaders have a capacity for handling 35,000 to 40,000 tons of ore a day, running double shift. The other plant completed in the year was built by the Baltimore & Ohio Railroad Company at Lorain. It included three Brownhoist plants with 9-ton buckets and a rehandling bridge, the whole having a capacity of over 20,000 tons a day, double shift.

Ohio docks are now quite well equipped for handling the lake ore output, but by the close of 1913 some additional machinery will be installed. The Wheeling & Lake Erie Railroad will remodel and rebuild its plant at Huron, Ohio, and install equipment, which will probably include two 15-ton plants. A new power plant will also be built. Extensions to some of the other existing dock plants are also being considered.

While Lake Erie docks are generally supplied with modern ore-handling equipment some of the present coal-handling plants are out of date, being insufficient to handle the larger coal cars that railroads are now using. The Pittsburgh & Conneaut Dock Company will build a new car dumper at Conneaut to replace its coal-handling equipment at that port, and the Hocking Valley Railroad will install a new car dumper at Toledo, in connection with extensive dock improvements that it will shortly make in that city.

The completion of the Belt Line Railroad in Cleveland early in the year made several large tracts of land available for manufacturing sites, and a number of new plants are being erected along these railroads, some of the most important being referred to below:

Extensions of Cleveland Machinery and Foundry Plants

The most notable extensions in their scope were those of the National Quality Lamp Division of the General Electric Company. This company acquired extensive new sites in East Cleveland, on which it has nearly completed seven large, modern and artistic buildings providing 400,000 sq. ft. of floor space, the greater part of which will be used for its engineering department and laboratories, the remainder being for general office purposes. In the year the company added 100,000 sq. ft. to its East Forty-fifth street works and built a warehouse 80 x 185 ft. On another site on East 152d street this company has started the erection of a metal department 80 x 320 ft., three stories and basement, and on the same site it plans to erect eventually 14 buildings in units 80 x 160 ft., three stories and basement, five of these to be used as glass works and the remainder for other departments. Some of these additional buildings may be erected this year.

The Allyne-Ryan Foundry Company, a new concern, has about ready for operation a new foundry 112 x 280 ft. The plant was designed particularly for casting automobile parts.

The Superior Foundry Company has started the erection of extensions to its plant which will include a foundry addition 90 x 350 ft., and pattern storage building 50 x 130 ft.

The Atlas Car & Mfg. Company will shortly begin the erection of a new plant consisting of two main buildings, each 100 x 400 ft., one story.

The Perfection Spring Company was engaged the entire year in building extensive additions to its plant which provide 110,000 sq. ft. additional floor space, doubling the company's capacity. Its products are automobile springs.

The Taylor & Boggis Foundry Company completed the rebuilding of its No. 2 plant, which includes foundry and lock-making department, largely increasing its capacity.

In the early part of the year the Ferro Machine & Foundry Company built a two-story addition to its foundry, 90 x 300 ft., which was followed by the erection of an addition to its machine shop, 118 x 238 ft., three stories and basement.

The Chandler & Price Company completed a large two-story foundry, with two lower levels for castings and sand storage in which to make castings used in the manufacture of its printing presses. This was described in *The Iron Age* of September 19.

Bardons & Oliver, makers of turret machinery, have under way a six-story steel addition to their plant, 56 x 130 ft., which will be completed about July 1.

The Winton Gas Engine Company, a new concern, erected a one-story plant 80 x 300 ft., which is now in operation.

The Osborn Manufacturing Company, maker of molding machines, foundry supplies, etc., has about completed a three-story brick addition to its plant.

The Globe Machine & Stamping Company completed a new plant on a new site doubling its former capacity.

The Hydraulic Pressed Steel Company has completed a large addition to its plant and has two others on the way that will provide 30,000 sq. ft. of additional floor space.

The Atlantic Foundry Company has begun the erection of an addition 110 x 200 ft., and will install an additional cupola.

The Hart Mfg. Company, maker of pipe threading machinery, is completing a new two-story plant about 150 x 250 ft. that will double its present capacity.

David Round & Son, makers of hoists and chains, have built a new two-story plant 70 x 300 ft.

The W. S. Tyler Company has under construction a large four-story brick and steel addition.

The Grant Motor Car Company last year erected a new one-story plant 100 x 400 ft.

The Grabler Mfg. Company built a four-story addition to its plant.

The Cleveland Machine & Mfg. Company rebuilt a portion of its main building, enlarging its plant considerably.

The Champion Machine & Forging Company has started work on additions that will double the capacity of its forge department.

The Foster Bolt & Nut Company has nearing completion two plant additions, doubling its capacity.

The Frost Wire Fence Company has recently built a new plant consisting of a main building 80 x 180 ft., store room 50 x 150 ft., and an office building.

The Mechanical Rubber Company built a four-story addition, 100 x 150 ft.

The New Process Stove Company Division of the American Stove Company is enlarging its plant by the erection of a one-story structure for japanning and a three-story building for machine shop, annealing and storage.

The City Brass Foundry Company built a two-story addition 50 x 116 ft.

A new plant was built by the Draper Mfg. Company, maker of steel barrels.

The Guide Motor Lamp Mfg. Company has under way the erection of a two-story plant 60 x 130 ft.

The West Steel Castings Company extended its plant, nearly doubling its capacity.

The Ohio Blower Company moved into new quarters giving it twice its former capacity.

Among other Cleveland companies that enlarged their plants during the year were the Park Drop Forge Company, the Cleveland Metal Products Company and the Standard Welding Company.

New Construction in Northern Ohio Industrial Cities

Canton forged ahead during the year with important extensions to its manufacturing plants and the establishment of some new industries. The United Steel Company in that city made important additions to its plant, which are mentioned elsewhere. The Canton Metal Ceiling Company, a new concern, completed and placed in operation a plant 50 x 400 ft. for the manufacture of ceiling and other sheet metal products. The Eller Mfg. Company, maker of sheet metal goods, secured a site on which it will shortly begin the erection of a new one-story plant 280 x 300 ft. The Berger Mfg. Company completed the erection of one section of a four-story addition, and the erection of the other section is now under way. This building will be 80 x 380 ft., and will be used largely for its metal furniture department. Extensions were made to the plant of the Canton Mfg. Company, maker of sheet metal products, doubling its former capacity. Large extensions were made by the Canton Steel Foundry Company. The Timken Roller Bearing Company and the Cleveland-Canton Spring Company also built large additions.

At Niles the Deforest Sheet & Tin Plate Company enlarged its plant. Extensions were also made to the Niles plant of the Stanley Works.

Several important new industries were established in Warren in 1912. The Trumbull Steel Company has under construction a sheet and tin-plate plant which will be placed in operation about May. The Warren Tool & Forge Company, also a new enterprise, built and put in operation a new plant 75 x 225 ft. for making picks, vises, anvils, etc. The Ohio Steel & Wire Company, another new organization, has nearly completed a plant for the manufacture of special steel wire. An extension was completed to the plant of the Warren City Tank & Boiler Company.

At Alliance the Davies Mfg. Company, a new company, erected a plant for the manufacture of automobile frames and heavy stampings. This company, which has recently changed its name to the Davies-Bach Mfg. Company, has placed contracts for the erection of an extension 80 x 206 ft. Another new Alliance enterprise is the Buckeye Twist Drill Company which placed its plant in operation in the year.

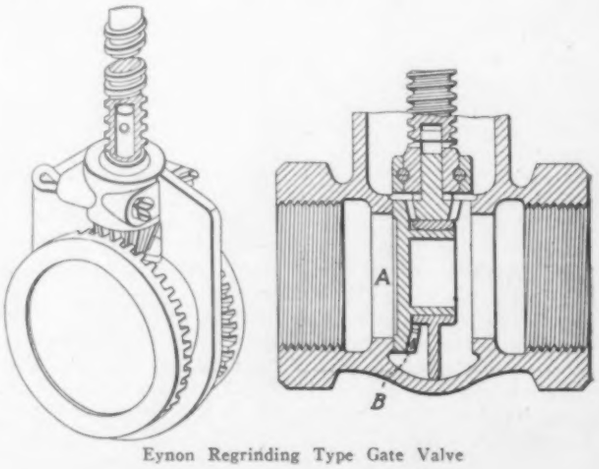
At Massillon an important industrial development was the consolidation of the Russell Engine Company with the Griscom-Spencer Company of New York and Jersey City under the name of the Griscom-Russell Company, which it is claimed will be the largest steam specialty manufacturing business in the country. The Massillon plant will be greatly enlarged and the Jersey City plant of the Griscom-Spencer Company is being gradually moved to Massillon. A new plant, largely increasing its former capacity, was erected by the Massillon Bridge & Structural Company. The Massillon Iron & Steel Company, maker of cast-iron pipes, was reorganized and its plant, which had been idle for some time, resumed operations. The Massillon Rolling Mill Company added one hot mill to its sheet mill plant and increased its cold-rolled finishing capacity about 100 per cent.

Akron, the center of the rubber tire industry, enjoyed unusual prosperity. Several of the great tire-making plants were greatly enlarged and other extensions are planned for the present year. Among the companies that either completed large extensions or have them under way are the Diamond Rubber Company, the Goodyear Tire & Rubber Company, the Firestone Tire & Rubber Company and the Swinehart Tire & Rubber Company.

At Elyria the Garford Company, automobile builder, completed a large addition to its plant and will shortly begin the erection of another building 40 x 300 ft. An extension was built to the plant of the Elyria Iron & Steel Company. The Ohio Nut & Bolt Company, Elyria, is building a large addition to its plant in Berea, Ohio. Other Northern Ohio construction includes enlargements of the plants of the Ohio Seamless Tube Company, Shelby, and the Standard Steel Company, Bedford. The National Stove Company, Lorain, announces that it will enlarge its plant by the erection of a building 60 x 110 ft. for its enameling department.

Regrinding Type Gate Valve

The new type of gate valve manufactured by the Eynon-Evans Mfg. Company, Philadelphia, Pa., and designed by Thomas M. Eynon of that city, shown in the line drawing, may be used either as a regrinding type or as an ordinary gate valve. It consists of two discs A having teeth cast on their inside surfaces and engaged by a small pinion B, which has a spindle extending into the valve stem to which it is held by means of a pin. The hand wheel actuates the pinion which causes the two discs to revolve in opposite directions, producing a grinding action on the discs and their seats, which serves to maintain perfect surfaces. As such action on any one part of the discs would naturally result in the formation of a ring, the discs are made concentric in every particular except as to their faces, which are eccentric, so that when the spindle rotates they not only revolve in opposite directions, but their faces rubbing on the corresponding surfaces of the valve body pass over them eccentrically. Therefore, all tendency to grind circles is eliminated. If the regrinding feature is not desired, it is necessary only to remove the pin holding the pinion spindle in the stem, in which case, should regrinding be desired, the top of the valve is removed and the pin inserted. The valve is made of iron, steel, brass, etc.



Eynon Regrinding Type Gate Valve

Lake Superior Iron Ore Trade in 1912

Increasing Dependence on the Beneficiation of Leaner Ores—Important New Merchant Interests Without Furnace Connections

BY DWIGHT E. WOODBRIDGE

It is significant of the great industrial expansion of the past decade that the product of iron ore from mines about Lake Superior last season was almost precisely double what it was at the beginning of the decade, in 1903. The 10,000,000-ton mark was rounded in 1895; double that was shipped for the first time in 1901; a 30,000,000-ton total was reached in 1905, and 40,000,000 tons in 1907. Probably in 1913 shipments will exceed 50,000,000 tons. In the past year as much as 8,000,000 tons was moved out of the upper lake region in single 30-day periods.

Features of the Year—The Strain on Reserves

The past year has been one of tremendous and accelerating traffic, and with a number of events having a deep bearing on the future of the industry. Labor was plentiful until late in the year, when the Balkan war caused the emigration of many foreign workmen, and the labor has been well remunerated. By virtue of the inauguration of safety devices and safety precautions by mining companies, accidents have been lessened and a mighty step has been taken in the humanities. Employers, especially several of the larger companies, have been very liberal in their treatment of their men, both in the way of financial aid to the injured and assistance toward the betterment of working, living and educational conditions. In no other section of the mining world has so much been done for the welfare of the operatives as has been and is being done by some of the mining concerns in the iron ore districts of Lake Superior. Probably there is no mining region in the world where the miners are more contented and prosperous as a class than on Lake Superior.

With a shipment of 48,300,000 tons, which is about what the final figures of the year will show, reserves must be practically limitless if they do not show the strain. Mines have been exhausted, and great holes are left where not long ago were level woods or rocky hillsides. Have the discoveries of the year kept pace with the depletion of stocks? With the assistance of the newest district, the Cuyuna, this exhaustion has been more than met; elsewhere, aside from the Menominee district, there has been little added to reserves. It can now be said that there are not less than 250,000,000 tons of "probable ore" on the Cuyuna. Not that so much is actually measurable, but drillings and shafts indicate at least as much to be likely in the not distant future. Aside from this there are in that district many hundred million tons of material too lean for direct shipment, but that will be ore when the necessity arises, either from a reduction of grades or from the introduction of methods of beneficiation and improvement.

Cuyuna and Vermillion Ranges

In the coming season the Cuyuna will increase its number of shipping mines and add to its output very materially. Several new properties are now being opened by shafts and by stripping, in preparation for the year's business. One of these, which has been taken over by Tod, Stambaugh & Co. and the Brier Hill Iron Company, is under an 80-cent royalty, which is the highest yet paid in that range. The Northern Pacific road has taken a large property at a 70-cent rate, and is evidently preparing to control the mining of ore for the market. In the year a number of holes have been sunk into a manganiferous ore, the extent and value of which seems as yet to be somewhat doubtful. A few cars have been shipped, and at a profit, but the ore is bunchy and largely non-Bessemer, so that its sale and use is restricted. This area of manganese ore seems to be parts of sections 3, 4, 10 and 11, township 46-29, and in 22, 23 and 34, township 47-29. One of the operators there has made shipments and sales for the coming year, while others are busily preparing their properties for shipment later.

In anticipation of increased business from this district the Soo Line and the Northern Pacific are adding dock space, and the latter will enter the field as an ore handling company for the first time.

Developments on the Vermillion for the year seem to have established the fact that two new mines will soon be added—one the property of the Vermillion Iron & Steel Company, and the other belonging to the Vermillion & Mesaba Iron Company—the former near the Northeast end of Vermillion lake and the latter a mile south of the city of Ely. This district has been, since its beginning, under the control of one company, but has now several independent properties, and that of the Section 30 Company shipped last year 153,900 tons, which it will increase to nearly 500,000 tons in 1913. The Chandler is another independent, and the White Iron Lake Iron Company sent out a trial carload. A 40 per cent. reduction in freight rates from this district aids it materially.

More Mesaba Ore for the General Market

On the Mesaba the chief tendency of the year was toward the increase of ore that will be on the open market. Two great companies are now opening properties from which they will soon be able to ship a tremendous tonnage of good ores. The Great Northern Ore Properties have begun the development of three open pit groups of mines, one of which is in 58-19, another in 58-20 and the third in 57-21. It intends to add others to the list so that in 1915 it may be able to ship not less than 3,000,000 tons a year. The Sargent Land Company, whose ore lands were included in the Great Northern lease to the Steel Corporation, is opening a very large mine in 56-24, at the village of Keewatin, and will have other mines elsewhere on the Mesaba and in other districts, so that it, too, will be able to mine a great tonnage of available ore. Neither of these companies has any furnace affiliations, and in this they are almost unique among the merchant ore firms of the Lake region. They will rank easily as the chief miners and shippers of merchant ore, and their advent is of the highest importance to all furnace and steel works operators that are not amply supplied with ore in reserve. They will have an important bearing on the future course of iron ore prices. The action of the Sargent Land Company, which is owner of the Pillsbury, Bennett & Longyear lands, would seem to indicate the disintegration of the Great Northern holdings so far as they include the majority of the ore tracts from which the Great Northern trust derives no benefit. Of this class of holdings the lands of the Sargent Land Company are chief. The parties in control of this company own other lands on both the west and the east Mesaba, and are developing mines in the Cascade district of the Marquette and in the Menominee.

A great tonnage was mined from the lands of the Great Northern in the past year by the Steel Corporation—in all about 9,900,000 tons, and applicable under the lease some 8,000,000. This latter figure is 3,500,000 tons above the year's minimum, and cleans up all deficiencies that had been paid for by the corporation, so that it starts the new year square with the Great Northern lease. The achievement of such a total from these lands is a great one, and reflects the highest credit on the efficiency of the Oliver Iron Mining Company, that did the work. Ores mined under this lease in the year are supposed to have been from 1 to 2 per cent. below the standard fixed as base grade, and the average royalty paid is estimated at about $1.18 a ton.

Wisconsin and Michigan Districts

In the Gogebic district there has been little change from the preceding year, except that exploration has revealed the fact that the iron-bearing formation is productive, in spots at least, several miles to the east of the former limit. The Presque Isle Iron Company is now sinking a shaft some distance to the east of Sunday Lake, which has been considered the limit of profitable formation. De-

velopment at great depth has been continued and the district, long ago pronounced past its prime, seems to be in its adolescence. For the second time the famous Ashland mine has reverted to the fee holders, who are now exploring for additional ore deposits. In 1898 it was turned over to them by the Penokee & Gogebic Development Company (Rockefeller) after its little remaining ore had been scrammed, its pillars caved and the mine left as exhausted. Then the fee holders, acting on the advice of their mother, a spiritualist living 3000 miles away, and who had never seen the mine, developed so much ore that shipments under the succeeding lease have been more than 3,500,000 tons, returning half as many dollars to the owners. Now it is again dropped, and Lake miners are wondering if the former experience can be repeated.

The Menominee, for many years a most favorable field for exploration, on account of its wide, persistent, strong formations, the nature of its ore deposits and their location, has been, as usual, the scene of much successful exploration. If other districts appear to have renewed their youth, the Menominee has been born again, and I am willing to venture the prediction that as much ore will probably come from the Michigan districts—and first of these the Menominee—before their final exhaustion, as the Mesaba will produce. And I do this although today the known reserves of all the Michigan ranges combined are about one-tenth of those of the Mesaba district.

Many developments have been made in the past year in the way of new mines, additional reserves at old properties, new equipment, the reopening of old shafts and mines that had been long idle. This has been especially true of the vicinity of Mastadon, where the Bennett & Longyear interests have discovered an important mine; of the section about Iron River; at Palatka; near Norway, and at Iron Mountain and elsewhere. Explorations are under way now in many parts of the Menominee and Crystal Falls section and the districts look well.

In the Marquette district the more interesting developments of the year have been in the section near North Lake; west of Ishpeming at the Diorite mine of M. A. Hanna & Co.; at Gwinn, and in the Cascade section. Important hydraulic power propositions have been carried out, great advances have been made in power equipment, and the district is now prepared to produce ore at lower costs than ever.

Leaner Ores Have Attention

The attention of far-sighted mine operators has been especially directed to the matter of ore dressing, in order to fit the lean merchantable ores of the Lake region for the blast furnace. A merchantable ore is, of course, any iron-bearing material that can be sold at a profit, whether it exists in the ground form for shipping or must be concentrated and freed from gangue matter. The quantities of material in the Lake region on which skill and science can experiment with hope of ultimate success are almost limitless. They exceed by many fold those quantities of ore that are merchantable as mined. The vast reserves of minable ore do not look so inexhaustible now as they did when the annual production of these mines was half what it is today, and it is more than prudence to prepare for that time when leaner ores must be used or the predominance of the Lake district be surrendered.

At present plants for ore dressing are in more or less successful operation or are under construction, that are based on reducing moisture, on jig concentration for elimination of gangue, on magnetic concentration of magnetic ores, on the briquetting of colitic ores, on the calcination of carbonate ores. Experiments are in progress that hope for the metallization of lean ores preparatory to concentration and disposal of gangue minerals, and for the roasting of pyrrhotite ores for the evulsion therefrom of the injurious sulphur.

Ore Drying

The mining firm of M. A. Hanna & Co. has led in the department of ore drying. Possibly this has been because it has been mining ores higher in moisture than most of those around the Lake. At its Brunt mine, Mesaba district, two Atlas driers have been in use the past year. The work has shown that heavily built machines are needed, and two more are to be installed immediately by the Ruggles-Coles Engineering Company, while the former machines are to be considerably reinforced. The two new driers are each to have capacity for reducing 22 tons per hour from an 18 per cent. moisture content down to 6 per cent. A total of 105,000 tons of ore was treated last year in the present driers, all of which was mixed with crude mine shipments, thus materially lowering the moisture of the whole.

Concentration and Calcination

In the matter of the jig and table concentration of lean hematite ores the same firm has erected and is now operating a plant at its American-Botson mine, in the Western Marquette district. This is fitted with Richards pulsating jigs and Diester slime tables, and was built for a daily capacity of 500 tons. For various reasons this capacity has not been reached, but it is believed that it will be passed in the near future and that the process is entirely practicable.

A small magnetic concentration mill is in operation at Trenton, Ontario, by the same progressive firm. A works for Grondal magnetic concentration and briquetting is to be in operation at the Moose Mountain mines, Ontario, next spring. Investigations are in progress looking toward the magnetic concentration, by the Grondal or other processes, of other Lake Superior ores, both in Minnesota and Ontario.

At the Magpie mine of the Lake Superior Corporation a works for the calcination of siderite ores is to be ready for operation soon. Its scheme is that of a revolving cylindrical inclined tube, with heat sufficient to drive off the carbonic acid gas and the sulphur of the ore. It was planned that this plant should be in operation some time ago, but for some reason there has been considerable delay.

Experiments with the extraction of sulphur from the pyrrhotite ores of the Atikokan district, northwest of Lake Superior, have been conducted for some time by English engineers, working under a commission from MacKenzie, Mann & Co. These have resulted in the determination by that firm to erect one Wedge furnace in the district preliminary to extensive operations in mining and steel making, which latter branch of the enterprise will be conducted at the city of Port Arthur, Ontario. Previous and very costly experiments by the same interests along this line have been somewhat disastrous, and it is understood that the blast furnace that was built at Port Arthur is to be torn down. But the ores that were used in this furnace differ somewhat from those now to be desulphurized.

The Jones Step Process

The radical departure of the Jones Step Process furnace is intended to convert into a commercial product certain low grade hematite ores by bringing the ore into contact with sufficient heat to drive off its oxygen without in any way fluxing or melting the ore. Once thus metallized, crushing and concentration was to be employed to produce a very high grade product, fit for the furnace or for the steel works direct. The difficulties met proved so serious that the scene of the work has been removed to the metallurgical laboratories of Harvard University, and trials of the process are under way there. Several hundred thousand dollars have been expended in this experiment and it is one that if successful will be of the most widereaching importance.

Improvement of Sandy Ores

Concentration works for the extraction of free sand from sandy West Mesaba ores was built the past year at the Hawkins mine, at Nashwauk. It has been so successful as to draw upon the company a lawsuit, in which the fee owners of the mine attempt to prevent the operators from mining and concentrating the lean material except at a higher royalty rate than was stated in the lease. While this suit is not yet decided, it is safe to say that barring astigmatism on the part of Justice, the operators will win. Of the 650,000 tons mined at the Hawkins the past year, all but 150,000 went through this concentrator. In the great similar works of the Oliver Iron Mining Company there was a season product of about 2,500,000 tons, and the weekly output sometimes ran above 90,000 tons. This works was designed for 10,000 tons a day.

Small Dividends in 1912

Many mines did not earn very large dividends during the year, for ore prices were low. But there has been an advance of from 55 to 65 cents a ton on the various grades of Lake ore for delivery in 1913, and the only offset to this difference are an additional 5 cents in the Lake freight rate, higher costs of supplies and a possible increase in the labor item. The mining business for the year should be in greater volume than ever and on a remunerative basis. The dark and portentous clouds hovering over it are general tariff reductions and a scarcity of labor. As to the probable freelisting of iron ore itself, mining men are not especially concerned. They have accepted what they think is the inevitable, and they realize that it is a matter of minor consequence in any event.

Of eleven mines around the Lake that were in the million-ton class this year, ten are operated by the Steel Corporation, and nine of them were on the Mesaba. The average individual shipment from these mines was 1,550,000 tons.

New Iron and Steel Works Construction

Additions to Open-Hearth Steel Capacity Under Construction or Planned Represent More than 3,100,000 Tons a Year

In sharp contrast with the condition of one year ago, of which it was said in these columns that "not in many years has so little new construction been under way in the steel industry, or planned for early erection," the exhibit of new steel capacity coming forward as 1913 opens is large beyond precedent. Independent steel company additions, or new projects for which contracts have been let, represent a total of 61 open-hearth furnaces, with an annual capacity of about 2,100,000 tons of ingots, while the United States Steel Corporation subsidiaries have under construction a total of 27 open-hearth furnaces with an annual capacity upwards of 1,000,000 tons. With two exceptions, every considerable independent steel company in the country is adding to its open-hearth capacity; four subsidiaries of the Steel Corporation are also building new open-hearth furnaces, and two new producers are coming forward with important additions—the Brier Hill Steel Company at Youngstown and Corrigan, McKinney & Co. at Cleveland. In succeeding columns details are given of these various additions. Much of the new capacity, probably 1,500,000 tons a year, will be ready for operation by the middle of 1913—the greater part of this nearly 50 per cent. by the end of the first quarter. Half the remaining furnaces which are building or under contract, representing 1,600,000 tons, could no doubt be finished before the end of the year.

The situation as to new blast furnaces is the reverse of that in respect to new open-hearth capacity in that few blast furnaces are now under construction, while a considerable number of new stacks went in blast last year. In the latter class are the following coke furnaces with capacity and date of starting:

	Capacity, Gross Tons.
Rogers-Brown Iron Company, No. 3, February 5	120,000
Rogers-Brown Iron Company, No. 4, August 1	120,000
Corrigan, McKinney & Co., Josephine No. 2, August 14	120,000
Corrigan, McKinney & Co., River No. 2, June 19	120,000
Jones & Laughlin Steel Company, Aliquippa No. 4, October 1	140,000
North Brothers Company, No. 2, December 4	125,000
Inland Steel Company, No. 2, April 3	140,000
Iroquois Furnace Company, C, July 30	120,000
Iroquois Furnace Company, D, May 13	120,000
Total	1,125,000

In addition to the above were the new alternate stack of the Alan Wood Iron & Steel Company at Swedeland, Pa., and the alternate stack of the Warwick Iron & Steel Company (Eastern Steel Company) at Pottstown, Pa., which were blown in on April 25 and May 20, 1912, respectively. There was also blown in last year (July 29) the Stephenson charcoal furnace in Michigan.

The list of blast furnaces now under construction is as follows, with expected annual capacity:

	No.	Capacity Gross Tons.
Pittsburgh Steel Company	2	280,000
Oriskany Ore & Iron Corporation	1	45,000
Youngstown Sheet & Tube Company	1	140,000
Minnesota Steel Company	2	280,000
Bethlehem Steel Company	1	150,000
	7	895,000

The furnaces of the Youngstown Sheet & Tube Company, Youngstown, Ohio, and the Oriskany Ore & Iron Corporation, Lynchburg, Va., will probably go in in the next few months. The blowing in of the Pittsburgh Steel Company's furnaces at Monessen is indefinite. Those of the Minnesota Steel Company and the Bethlehem Steel Company will probably not be completed until the year is well along.

Independent Steel Companies

Lackawanna Steel Company

In the past year the Lackawanna Steel Company has completed and placed in operation an extension to the No. 1 open hearth plant, consisting of two 60-ton basic furnaces of the stationary type, also extension to buildings, stock yard and gas producer plant, in which there were installed eight 10-ft. Morgan producers. In connection with the construction of these two furnaces, there has been installed a 165-ton ladle crane, built by the Morgan Engineering Company.

A 600-ton capacity hot metal mixer has been installed at the north end of No. 1 open hearth plant and adjoining the furnace building. It was built by the Pennsylvania Engineering Works. It is served by a 75-ton Morgan crane and is set at such an elevation that metal pours from it into ladles on transfer cars on the charging floor level and is delivered by them to the furnaces. Including the two furnaces recently completed, the No. 1 plant now comprises 14 furnaces and one 600-ton mixer.

The company also has under construction a second open hearth plant to be known as No. 2 plant, consisting of two 200-ton tilting furnaces, located north of and adjoining the Bessemer steel works, in connection with which they will be operated on the duplex process. This plant will be of very massive construction throughout and will be equipped with Morgan cranes—two 165-ton ladle cranes over the pit, a 75-ton ladle crane over the charging floor, and a high type charging machine. Gas for these furnaces is furnished by six Hughes producers, three for each furnace. These two furnaces operating on the duplex process will have an annual capacity of approximately 240,000 tons. In connection with the construction of the No. 2 open hearth plant, there is also being installed a calcining plant for the burning of lime, consisting of three 8-ft. diameter by 125 ft. rotary kilns complete with all auxiliary equipment of crushers and conveying machinery. The No. 2 open hearth plant will also be enlarged in the coming year by the addition of four 60-ton stationary type furnaces.

The company has under construction a bolt, nut and spike plant for the manufacture of track bolts and spikes. This will be contained in a brick and steel building of fireproof construction, 138 ft. span and 200 ft. long. The equipment to start with will consist of three spike machines, built by the Youngstown Foundry & Machine Company; one automatic roll feed bolt header, built by the Ajax Mfg. Company; two roll threading machines built by the Waterbury Farrel Foundry & Machine Company, and three hot pressed nut machines, which, together with nut burring and tapping machinery, are being furnished by the National Machinery Company. Steel will be heated in oil-burning furnaces of the Ferguson type. This plant will have a total annual capacity of 28,000 tons of spikes, bolts and nuts.

(Continued on page 122)

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The Record of 1912 and the Outlook

The most hopeful prophecies of one year ago fell much short of the facts about the American iron trade in 1912 as they can now be written. It was the year of the largest production of iron and steel in the country's history; of the largest home consumption and by far the largest exports of steel products. It opened with heavy orders upon the books of the steel companies, many of them taken at the low prices prevailing in the closing months of 1911, yet with the trade dominated by the belief that demand would need to go much farther to come abreast of a steel-making capacity rated at more than 30,000,000 tons a year. What is most remarkable about the year's performance is that before it was half over all the steel works of the country were straining under accumulated business, and from that time until December showed an uninterrupted gain in their unfilled orders.

Further, there is no parallel in American steel making for such a transition as came in 1912 from the common prediction that two or three years must pass before the gap between demand and capacity could be bridged, to a condition calling out plans or actual construction work to provide for an annual output of 2,000,000 to 2,500,000 tons a year more of open-hearth steel.

What was regarded as of special significance as last year opened was the evidence that to an extent business had outworn the fear of political damage. That feeling grew as the year advanced. Even the turmoil of a Presidential campaign so aligned as to make it a practical certainty from the beginning that important tariff reductions would result did not check the demand for iron and steel. The steel trade based its hopes for 1912 on overdue requirements of the railroads, whose average consumption in the four years preceding had been less than half as much as the average for 1905, 1906 and 1907. Measured by car buying, 1912 brought again the rate of these three years before the panic, with a total of nearly 250,000, or about twice as many as in 1911. That might be taken as proof that it was the railroads that caused the overflow of mill orders; but such a statement covers only part of the facts. In all lines low prices stimulated demand, again demonstrating that the way to lift a market is to get under it. The low cost of structural steel, for example, brought out a volume of extension work at manufacturing plants that was not regarded as a possibility a year ago. Manufacturing capacity was considered to be so far excessive in other industries as to make extensions in them quite as unlikely as in iron and steel; but the actual demand in the past twelve months for equipment for new plants and extensions has been of the sort usually found under boom conditions in the iron trade.

Market developments of the year are reviewed in detail on other pages. They show that there was some recession after January from the slight advances which had been made from the low level of November, 1911, but that beginning with March the course of prices was upward. Thus in October a basis was reached on contract business substantially on a level, in such products as bars, plates and structural shapes, with what steel manufacturers, under the régime of co-operation, were accustomed to refer to as "fair" to buyer and seller—1.40 cents for bars and 1.45 to 1.50 cents for plates and shapes. The higher mill prices paid for early deliveries, ranging from $3 to $8 above these levels, are matters of familiar history.

The great stride made in 1912 in advance of the greatest previous production records and the marked contrast with the performance of 1911 appear from estimates that may now be made of products that gauge the industry. The pig iron increase was more than 6,000,000 tons—29,750,000 gross tons against 23,649,000 tons in 1911 and a record of 27,303,000 tons in 1910. Steel ingot production, which has now come to be the measure of the industry rather than pig iron, was probably close to 30,500,000 tons, against 23,676,000 tons in 1911 and a record of 26,095,000 tons in 1910. In Lake Superior iron ore shipments the indicated total is about 48,300,000 tons, an increase of more than 15,500,000 tons over that of 1911 (32,793,000 tons) and comparing with the 1910 record of 43,492,000 tons.

Concerning the prospect for 1913 it may be said that American steel manufacturers have never entered upon a year holding greater promise for volume of business. Those in the trade who made the largest predictions for 1912 are now committed to prophecies of still greater things for the new year. So far as order books can give assurance, the outlook is full of promise. Of the one cloud that has been steadily in view—the expected tariff reduction—estimates range from the size of a man's hand to something of real portent. The history of 1912, it is true, reinforces those who consider the present wave of demand to be powerful enough to override any deterring influences attributable to tariff changes. Europe is pointed to, also, with the promise, barring the very unlikely event of a six-power war, that present prosperous conditions in iron and steel, due to persistent world-wide demand, will project themselves far into the new year.

One factor that should not be ignored in all these calculations is the high level to which the price structure has now been built up in the domestic industry. Lake ore cost has risen $1.25 per ton of pig iron in the year. Coke cost is from $1.25 to $1.75 higher, and the coke industry, even on its contracts with blast furnaces which were made before the late advances, has come into a 100 per cent. profit. Labor cost has risen markedly. The effect on consumption of such building up of the cost structure in iron and steel is one phase of the situation to which more attention will be compelled as the year advances. Consideration should not be omitted, moreover, of the large additions to steel-making capacity which, as indicated elsewhere, will soon begin to be felt in the relief of the present stringency. They should supplement in an important way the position of those in the trade who believe that prices of finished steel products are now high enough.

Industrial Terrorism and the Law

Among the memorable events of 1912 history will record the conviction at Indianapolis on December 28 of 38 of the 40 men charged with complicity in a country-wide dynamite conspiracy. Of the convicted men all but two were national or local officers of the International Association of Bridge and Structural Iron Workers. One of the two outsiders was secretary of the California Building Trades Council and the other was an organizer for the United Brotherhood of Carpenters and Joiners. They had aided the dynamiters in their nefarious work, which was begun in 1905 when a campaign of violence was inaugurated in the fabricated structural trade against open-shop contractors. From that time explosions continued with more or less frequency in various parts of the country until about 100 bridges or buildings under construction by non-union workmen had been blown up, while many other minor outrages had been committed, such as the slugging of men, the cutting of derrick guy ropes, the weakening of scaffolds and similar methods of intimidation.

It is probable that these crimes would not have covered so many years nor spread to so many localities if municipal authorities had shown the proper vigor and fearlessness in protecting non-union men in their jurisdiction against violence that had been openly threatened. The weakness in executive ability or the fear of organized labor which was almost universally manifested by local authorities so emboldened the dynamiters that they extended their field of industrial terrorism more and more widely until they became so reckless as to undertake the extermination of men who had aroused their hostility by attacking lawless acts of union leaders. Of this character was the fearful outrage at Los Angeles in October, 1910, when a score of lives were wiped out in the effort to destroy an editor who had been outspoken in his denunciation of just such methods of intimidation. This was the culmination of the campaign of destruction of property and human life that had been conducted for five years, and probably if the affair had been left entirely to be handled by local authorities the cause of the Los Angeles explosion would have forever remained a mystery. Detective work under the direction of the National Erectors' Association, which had been progressing for some time before, speedily found a clue to the miscreants and the McNamaras, who were indicted, pleaded guilty to escape the gallows. The crime was thus fastened on the Iron Workers' Union and a way was opened for the United States Government to make a strong effort to punish numerous officers of that organization for the reign of terror to which they had subjected an important industry and thousands of workingmen for so long a time.

When the trial of 40 men was announced as to be undertaken in the United States Court at Indianapolis over three months ago, it seemed almost too great a stretch of credulity to expect that any considerable number of them would be found guilty. It was like trying to convict a whole company of soldiers or the entire membership of a society. Charges can easily be made by wholesale, but a wholesale conviction is another matter. The accused men were represented by eminent and experienced counsel, well calculated to impress a jury and alert to play upon any prejudices or on any bond of sympathy to influence a vote against conviction. Surveying all the circumstances, notwithstanding the array of evidence so well presented by the prosecuting attorney, it is a marvel that not a man among the jurymen stood out against his colleagues to cause a disagreement. The verdict of this jury may be taken as another indication of the awakening of the public conscience, as it follows closely on jury decisions in Atlantic City, New York City, Detroit and elsewhere that had been hoped for by good citizens, but not expected. Intimidations and sophistries of counsel as well as fears by jurymen of personal safety have not had their usual effect in these memorable cases. The jury system, which had almost fallen into disrepute,

has been vindicated and the law is resuming its power and majesty. The conclusion may be hardly warranted, but the hope can be expressed that this awakening of the public conscience may extend to mayors, sheriffs and other officials who have been chosen by their constituents to enforce laws, preserve peace and especially to suppress violence in times of labor troubles. The rule of law has at last been most painfully established despite the ruthless and almost successful attempt to impose a reign of labor leaders who recognized no laws but those of their unions.

So heinous were the crimes of which these men have been convicted that it is to be hoped that no technicalities devised by astute counsel may be found sufficiently potent to avert the sentences which they deserve. And it is further to be hoped that the pardoning power may be unsuccessfully invoked even though an attempt be made to overcome the possessor of that power by petitions bearing countless thousands of signatures. Law has again been enthroned and the reign of dynamite is ended unless our local and national rulers show themselves to be weaklings.

Machine Tool Development in 1912

Since the period of radical redesigning which accompanied the adoption of high speed steel, changes in metal working machinery have come as a consistent, rapid evolution. Each year has contributed its share toward what may be termed refining processes of design. Few new types of machinery have been introduced excepting where the function to be performed is wholly special, but the improvement has gone on steadily, as is made evident by a comparison of a shop equipment built a few years ago with one made up of the latest designs of the manufacturers.

In dull times machinery builders turn their attention toward perfecting their lines. They have more time for a careful study of the product and of the demands which are to be made upon it. Sometimes however, it is a time of planning only and not of the actual execution of ideas, for when business is poor many houses are compelled to conserve their financial resources. The prosperity of 1912, coupled with a feeling of absolute confidence in future business, has caused the release of funds for the construction of machines which embody the improvements that have been on paper for some time. In consequence the year's progress has been somewhat greater than usual. Few of the new ideas are radical departures, but they combine to make machinery more efficient, either by increasing production or by improving the quality of the product, and in some cases they effect both results.

The demand of buyers for the maximum of simplicity in machine tools is becoming more pronounced, and the builders are co-operating with them by giving expert study to the purposes for which new equipment is to be used. Take the engine lathe, for example. A few years ago the designers had reached a point where the individual machine combined in its mechanism everything necessary to perform all classes of work within the scope of a lathe, together with extreme facility of operation. There is to-day a large market for such a machine, but at the same time the demand has increased sharply for lathes having only such mechanism as is required for a specific task. In some cases such a lathe might almost be classed as a special tool because of its very simplicity. The reason for this new demand is obvious; in the specialized method of modern machine shop practice, enough work of a given class is put through the plant to keep the machine busy. It is not called upon for all around work. The same condition exists with other types of machinery and is a potent influence in design. This has been strongly in evidence during the past year.

The year has seen a broad extension in the use of the grinding machine. In nearly every line of metal working greater accuracy is being required and the grinding machine is an invaluable agent for accomplishing this result, on cylindrical and surface work and on irregular forms. The surface grinding machine is taking its place with the milling machine in performing work that formerly was done almost exclusively on planing and shaping machines, just as the cylindrical grinding machine is not only supplementing the labor of cylindrical cutting machines but is producing work from the untooled metal. As for the highly specialized machines built to accomplish the one task with a maximum of production and economy, progress has been consistently rapid.

The American machine tool has held its place as compared with the product of other nations. The progress of development abroad has been rapid, as the designers have taken advantage of American models, but constant effort on the part of the builders of the United States in forging ahead in quality and in the excellence of their design has been well rewarded in 1912 as heretofore.

Selecting Industrial Locations

In selecting a site for a manufacturing plant careful attention should be given to the character of the soil. More frequently than would be thought owners fail to go into this detail with sufficient thoroughness, and the result may be that the cost of building is seriously augmented in the overcoming of difficulties which are due to soil conditions. In one typical case of this sort quicksand was encountered in excavating and many thousands of dollars were expended which had not been taken into account in the estimate. The owners frankly stated that had they made preliminary borings, another property would have been chosen. In fact, the decision between the accepted location and another was made almost by the toss of a coin. On the other hand, the value of a piece of land may be greater than had been anticipated, and on this account also preliminary investigation may result in a more intelligent decision between several locations. In purchasing land for a foundry recently the owners had no knowledge that they were acquiring not only space upon which to build, but an almost inexhaustible supply of sand suitable for molding purposes and of excellent gravel for which there is a ready market in the vicinity. It might very well happen that the decision would be between a piece of land containing quicksand and one containing valuable sand and gravel, with no surface indications of either. The cost of boring is not great, but it might mean the difference between a valuable asset and a serious expense.

A more systematic method of routing work through the shops of the United States armory at Springfield, Mass., has resulted in the reduction of working time required to complete a rifle from 24 to 17 hours, according to the report of the chief of ordnance.

New Lake Ore Dock Construction

The Evolution Which Has Taken Place in Forty Years

DULUTH, MINN., December 28, 1912.—The evolution of the iron ore shipping pier of the Great Lakes presents an interesting sidelight on the progress of the ore trade. Appropriations have been passed and in a few days the first contracts will be let for the construction of what will be the most advanced type of ore dock to be found anywhere. It will cost somewhere between $2,500,000 and $3,000,000 and will take two years to complete. It is to be built at Duluth by the Duluth, Missabe & Northern Railroad, for handling ore from the Mesaba range. The structure will be 80 ft. from water level to the deck carrying the trains, or about 110 ft. from firm foundations to the top; it will be 64 ft. wide, and 5000 ft. long, of which 2304 ft. will be in deep water, the rest on land. It will have 384 pockets of a capacity for 300 tons each, or a gross storage capacity for 115,000 tons. There will be no timber in the structure above the water line except what is needed for lining the pocket floors, and this will be maple. The deck will be reinforced concrete, treated with granitoid to prevent slipperiness, and the divisions between pockets will be reinforced concrete. An all steel railroad approach half a mile long, independent of those reaching the three other piers of the system, will connect this pier with the main line of the railroad. The piling for the foundations will be put in this winter, the concrete next year, and the dock will be completed in time for the business of 1915.

Next to this in size and capacity is the Great Northern No. 1 pier at Superior, which is longer, but 8 ft. lower; it is also steel and concrete but with a wood deck. Several other companies have built steel docks since the initial experiment in this line, by the Duluth & Iron Range Railroad in 1907. That dock would look ludicrously light beside those of the past year or two. The idea of steel shipping piers was first brought up seriously in 1900, and was pressed on account of the danger of fires in the vast wood structures and of the disastrous results that such fires would have on the ore trade and on the blast furnaces dependent on supplies of Lake ore. It is a fortunate thing that there has never been a serious fire in any iron ore shipping dock on the great lakes. But the cost of steel compared with wood was so great in 1900 that construction was delayed. The estimates then were that the equivalent capacity would cost five times as much in steel as in wood. When the first dock was actually built the cost ratio was reduced to three times as much as for wood, and now it is about twice as much. As the life of a wood dock is not more than eight to ten years while that of a steel and concrete structure is estimated at not less than 25 the expenditure of this difference is considered fully warranted.

The first ore shipping docks on the great lakes were built at L'Anse, Marquette and Escanaba in the early '70s. That at L'Anse was erected in 1872 by the Marquette, Houghton & Ontonagon road, and a description of it is given in the first volume of the Geological Survey of Michigan, published in 1873. This dock was of wood, 546 ft. long, 36 ft. wide and 38 ft. high, and was considered a marvelous piece of construction. It had 80 "vessel pockets" and four "steamboat pockets." Ore was delivered to vessels from these pockets in the same way as at present, that is by gravity, the ore running down spouts, the upper ends of which were 20 ft. above water. But the four steamboat pockets were but 12 ft. above water, and ore from them was spouted into handcarts, which were wheeled on board the steamers!

The first Marquette dock was a trifle bigger—the increasing size of ships compelled the railroad to add to the size and length of its dock. This has been the incentive of dock builders ever since; the ships have demanded hight and capacity and speed and have been accommodated. This dock was 720 ft. long, 53 ft. wide and 38 ft. high. Its pockets had a capacity for 55 tons each and as much as 6000 tons was loaded in a single day. Now a single day's work of a dock must be over 200,000 tons to be considered remarkable. At that time the average capacity of vessels was above 650 tons, and of the largest ships built it was 1100 tons. To-day ships will carry 13,000 tons and the average cargoes for a season will run about 8500 tons.

Other ore dock construction planned for this winter includes a short steel and concrete pier for the Northern Pacific road, the reconstruction of a Chicago & Northwestern pier at Ashland and the doubling of the Soo Line dock at Superior, which now has 200 pockets and a capacity for 60,000 tons.

The Duluth, Missabe & Northern and the Duluth & Iron Range are ordering 2000 50-ton ore cars and 12 locomotives, at an estimated cost of about $2,450,000. Equipment purchases by other iron ore roads will be small.

Prompt Attention to Callers

Business men who call at works or executive offices narrate as part of their experience that frequently they have to waste much time in order to be received by the proper person. Salesmen complain that too often they are informed after an unreasonable period of delay that their call is inopportune. Again, these waits are sometimes interspersed with unpleasant experiences with subordinate employees of poor judgment. The great majority of offices, it is true, have arrangements for receiving visitors which cause an avoidance of these conditions, yet the number where methods could be bettered is surprisingly large, as can be learned from any well-traveled salesman. Where the man who sells is expeditiously and pleasantly received, the effect is to implant a feeling of friendship and when the name of that company is mentioned it invariably elicits praise and appreciative words that constitute good advertising. This should be considered by those who perhaps unwittingly pursue different tactics with their callers. Of course, it is easy to stop with the thought that the visitor is merely a salesman seeking to do business and that he must bide his time, or that he has nothing of interest to offer, but should not a little of the Golden Rule be exemplified here and the salesman be received by someone, if only for a moment, and told when he can have an interview or else that his quest is useless? Even a harassed purchasing agent can be pleasant, while convincing and positive, however persistent his caller may be.

It is the custom abroad for nearly all business interviews to be arranged by appointment, and while that is done to a considerable extent here the press of time and business is too great to make that system one of universal practice. But, as many heads of companies and office managers have realized, the best possible provision should be made to conserve the time and even provide for the comfort of business visitors of all kinds and, as far as is practicable, give them the prompt attention which every company would like its own representatives to receive. An idea along these lines is afforded by a placard which is posted in the Madison, Wis., office of the Gisholt Machine Company, which reads as follows:

> VISITORS PLEASE NOTICE
>
> If YOU are not waited on PROMPTLY, please ring this bell. If you do not promptly see the party you wish to see, DO NOT HESITATE to ask for him a SECOND time. While we cannot always see you immediately we want to save YOU as much time as possible.
>
> GISHOLT MACHINE COMPANY.

In this connection may be mentioned an incident in the office of the executive of a large corporation whose operations are world-wide. Half a dozen callers were awaiting attention outside the door of his private office when a member of the Japanese nobility who in his own country had bestowed signal honors upon this particular executive was announced. Here is what happened. The first caller who had been waiting was ushered in, his business ascertained in a few words, a button pressed and the visitor then turned over to a department head, who was requested to hear the details of the subject. In rapid-fire order each visitor was cared for in the same way until the Japanese was reached. His call was brief and formal, and after his departure the quick-witted and courteous executive went to one after another of his managers, saw his callers again, picked up the ends of the matters in which they were interested and all went away feeling that they had received personal and satisfactory attention, and so they had.

If consideration for the salesman, or any business caller for that matter, were more general, would not the sum total of business efficiency be greater?

The Iron and Metal Markets

High Expectations of 1913

Further Orders for Rails and Cars

Large Transaction in Steel Making Pig Iron —Copper Sales at Full Prices

No year has ever opened for the American iron trade with any approach to the high pressure conditions existing to-day. Confidence is strong that 1913 will exceed 1912 in consumption of iron and steel, and if it so turns out it need not be said that the return will be far more satisfactory than for the year just ended.

The astonishing fact in the steel industry to-day is that manufacturers are hurrying work on more than 3,000,000 tons a year of new open-hearth capacity, whereas when 1912 opened the belief was widespread that the country's steel making capacity was more than 6,000,000 tons in excess of any probable requirements of the year.

This new plant that is coming forward is one of the two factors within the trade that signify most as to the year's market; the other is the high level to which iron and steel costs have been built up, and its effect upon consumption. So far as political influences are concerned, the trade is still asserting, rightly or wrongly, that they will prove no more harmful this year than in 1912.

In the past week as in the previous one the precedents of holiday quiet have been broken. Railroads have added to their rail purchases—the Harriman lines 12,000 tons more and the New York Central 7000 tons. The Monon has bought 4000 tons. A good export order, 30,000 tons for the Canadian Pacific, was taken by the Lackawanna Steel Company. The Harriman order for 12,500 cars will probably all be placed this week. For the Illinois Central 3000 have been bought, with 2900 pending. The Norfolk & Western placed 1000 and the Burlington 2000. Steel manufacturers are far from entertaining the view that the heavy railroad buying of 1912 will leave little for this year.

Leading mills are now sold on bars, plates and structural shapes well into the third quarter and in the Chicago district even farther, but 200,000 tons of car material has come up this week, which must largely be taken care of there.

Bar mill business has grown enormously and only the starting up of long idle iron rolling mills has averted a famine. Recent contracts in steel bars covering 1913 have been made at 1.40c. Pittsburgh. Some bar iron business for second quarter has been done at a $2 advance from the first quarter basis. The consumption of bars and various bar mill products has now reached a yearly rate put at 8,000,000 tons, or about 30 per cent of the total of finished iron and steel.

The vast expansion of the Lake ore trade is shown in the contract for a new steel and concrete dock at Duluth which will take 22,000 tons of structural steel. Delivery of the steel will not be required for a year.

A good many tin plate mills in the Middle West were idle in the holidays for lack of steel. In contrast, our cable reports that a number of Welsh tin plate works may shut down for lack of orders.

A Youngstown steel company has bought pig iron for the second half, taking 43,000 tons of Bessemer, largely at $17.25 at furnace, and 50,000 tons of basic, the latter on an arrangement to smelt ore.

There is more buying of foundry iron for third quarter. Buffalo sales have been fully 50,000 tons in the past week, chiefly in the East and for the second half of the year. The price was somewhat under the recent maximum. Buying by foundries which find their business increasing was noticed throughout December and is taken to point to more activity in foundry iron in January.

In eastern Pennsylvania one inquiry has come out for 7500 tons of pipe iron and other pipe interests have been negotiating for Southern iron, though a quotation of $13.25 Birmingham has not resulted in business.

Significant transactions in copper, after weeks of holding off, involve the purchase of 7,000,000 lb. by steel interests in the past week. Small lots of electrolytic were to be had at 17⅝c., but where large sellers were dealt with 17¾c. was paid. The reduction of consumers' stocks in Europe continues and knowledge of the situation there has been a full offset to any sentiment based on increase in domestic producers' stocks.

A Comparison of Prices

Advances Over the Previous Week in Heavy Type. Declines in Italics.

At date, one week, one month and one year previous.

	Jan. 1, 1913.	Dec. 24, 1912.	Dec. 4, 1912.	Jan. 3, 1912.
Pig Iron, Per Gross Ton:				
Foundry No. 2 X, Philadelphia.	$18.50	$18.50	$18.50	$14.85
Foundry No. 2, Valley furnace..	17.50	17.50	17.00	13.00
Foundry No. 2, S'th'n, Cin'ti...	17.25	17.25	17.25	13.25
Foundry No. 2, Birmingham, Ala.	14.00	14.00	14.00	10.00
Foundry No. 2, furnace, Chicago*	18.00	18.00	18.00	14.00
Basic, delivered, eastern Pa....	18.25	18.25	18.25	14.25
Basic, Valley furnace	16.50	16.50	16.50	12.25
Bessemer, Pittsburgh	18.15	18.15	18.15	15.15
Malleable Bessemer, Chicago*..	18.00	18.00	18.00	14.35
Gray forge, Pittsburgh.....	17.15	17.15	17.15	13.40
Lake Superior charcoal, Chicago	18.75	18.75	18.75	16.00
Billets, etc., Per Gross Ton:				
Bessemer billets, Pittsburgh....	**27.50**	27.00	27.00	20.00
Open hearth billets, Pittsburgh.	28.50	28.50	27.50	20.00
Forging billets, Pittsburgh.....	35.00	35.00	34.00	27.00
Open hearth billets, Philadelphia	32.00	32.00	32.00	22.40
Wire rods, Pittsburgh	30.00	30.00	30.00	24.50
Old Material, Per Gross Ton:				
Iron rails, Chicago.....	17.25	17.25	18.00	14.75
Iron rails, Philadelphia.....	18.00	18.00	18.50	16.00
Car wheels, Chicago.....	**17.25**	17.00	17.00	13.25
Car wheels, Philadelphia.....	16.00	16.00	15.00	12.50
Heavy steel scrap, Pittsburgh..	**15.00**	14.75	14.75	12.50
Heavy steel scrap, Chicago.....	12.50	12.50	13.00	10.50
Heavy steel scrap, Philadelphia	14.50	14.50	15.00	12.25
Finished Iron and Steel,				
Per Pound to Large Buyers:	Cents.	Cents.	Cents.	Cents.
Bessemer rails heavy, at mill...	1.25	1.25	1.25	1.25
Iron bars, Philadelphia.....	1.67½	1.67½	1.67½	1.27½
Iron bars, Pittsburgh.....	1.70	1.70	1.65	1.25
Iron bars, Chicago	1.57½	1.57½	1.55	1.15
Steel bars, Pittsburgh, future..	1.40	1.40	1.40	1.15
Steel bars, Pittsburgh, prompt.	1.70	1.70	1.60	1.15
Steel bars, New York, future..	1.56	1.56	1.56	1.31
Steel bars, New York, prompt..	1.86	1.86	1.76	1.31
Tank plates, Pittsburgh, future..	1.50	1.50	1.45	1.15
Tank plates, Pittsburgh, prompt	1.75	1.75	1.70	1.15
Tank plates, New York, future..	1.66	1.66	1.61	1.31
Tank plates, New York, prompt	1.91	1.91	1.86	1.31
Beams, Pittsburgh, future.....	1.50	1.50	1.45	1.15
Beams, Pittsburgh, prompt.....	1.75	1.75	1.75	1.15
Beams, New York, future.....	1.66	1.66	1.61	1.31
Beams, New York, prompt.....	1.91	1.91	1.91	1.31
Angles, Pittsburgh, future	1.50	1.50	1.45	1.15
Angles, Pittsburgh, prompt.....	1.75	1.75	1.75	1.15
Angles, New York, future.....	1.66	1.66	1.61	1.31
Angles, New York, prompt.....	1.91	1.91	1.91	1.31
Skelp, grooved steel, Pittsburgh	1.45	1.45	1.45	1.15
Skelp, sheared steel, Pittsburgh	1.50	1.50	1.50	1.20
Steel hoops, Pittsburgh.....	1.50	1.50	1.50	1.25
Sheets, Nails and Wire,				
Per Pound to Large Buyers:	Cents.	Cents.	Cents.	Cents.
Sheets, black, No. 28, Pittsburgh	2.25	2.25	2.25	1.90
Wire nails, Pittsburgh.....	1.75	1.75	1.70	1.55
Cut nails, f.o.b. Eastern mills..	1.75	1.75	1.75	...
Cut nails, Pittsburgh.....	1.70	1.70	1.70	1.50
Fence wire, ann'l'd, 0 to 9, P'gh.	1.55	1.55	1.50	1.35
Barb wire, galv., Pittsburgh....	2.15	2.15	2.10	1.85
Coke, Connellsville, Per Net Ton, at Oven:				
Furnace coke, prompt shipment	**$4.15**	$4.00	$4.00	$1.85
Furnace coke, future delivery...	3.25	3.25	3.25	1.65
Foundry coke, prompt shipment	4.50	4.50	4.25	2.00
Foundry coke, future delivery..	4.00	4.00	3.75	2.15
Metals,				
Per Pound to Large Buyers:	Cents.	Cents.	Cents.	Cents.
Lake copper, New York.....	**17.75**	17.62½	17.75	14.25
Electrolytic copper, New York..	**17.62½**	17.50	17.50	14.12½
Spelter, St. Louis.....	7.15	7.15	7.25	6.20
Spelter, New York.....	7.30	7.30	7.40	6.35
Lead, St. Louis.....	**4.15**	4.12½	4.20	4.35
Lead, New York.....	**4.30**	4.27½	4.35	4.45
Tin, New York.....	**50.65**	50.15	49.30	44.25
Antimony, Hallett, New York..	9.50	9.50	9.50	7.60
Tin plate, 100-lb. box, Pittsburgh	$3.60	$3.60	$3.60	$3.40

*The average switching charge for delivery to foundries in the Chicago district is 50c. per ton.

Finished Iron and Steel f.o.b. Pittsburgh

Freight rates from Pittsburgh in carloads, per 100 lb.: New York, 16c.; Philadelphia, 15c.; Boston, 18c.; Buffalo, 11c.; Cleveland, 10c.; Cincinnati, 15c.; Indianapolis, 17c.; Chicago, 18c.; St. Louis, 22½c.; Kansas City, 42½c.; Omaha, 42½c.; St. Paul, 32c.; Denver, 84½c.; New Orleans, 30c.; Birmingham, Ala., 45c.; Pacific coast, 80c. on plates, structural shapes and sheets No. 11 and heavier, 85c. on sheets Nos. 12 to 16; 95c. on sheets No. 16 and lighter; 65c. on wrought pipe and boiler tubes.

Plates.—Tank plates, ¼ in. thick, 6¼ in. up to 100 in. wide, 1.50c. to 1.75c., base, net cash, 30 days. Following are stipulations prescribed by manufacturers, with extras:

Rectangular plates, tank steel or conforming to manufacturers' standard specifications for structural steel dated February 6, 1903, or equivalent, ¼ in. and over on thinnest edge, 100 in. wide and under, down to but not including 6 in. wide, are base.

Plates up to 72 in. wide, inclusive, ordered 10.2 lb. per sq. ft., are considered ¼-in. plates. Plates over 72 in. wide must be ordered ¼ in. thick on edge, or not less than 11 lb. per sq. ft., to take base price. Plates over 72 in. wide ordered less than 11 lb. per sq. ft., down to the weight of 3-16 in., take the price of 3-16 in.

Allowable overweight, whether plates are ordered to gauge or weight, to be governed by the standard specifications of the Association of American Steel Manufacturers.

Extras.	Cents per lb.
Gauges under ¼ in. to and including 3-16 in.	.10
Gauges under 3-16 in. to and including No. 2	.15
Gauges under No. 8 to and including No. 9	.25
Gauges under No. 9 to and including No. 10	.30
Gauges under No. 10 to and including No. 12	.40
Sketches (including straight taper plates) 3 ft. and over	.10
Complete circles, 3 ft. in diameter and over	.20
Boiler and flange steel	.10
"A. B. M. A." and ordinary firebox steel	.20
Still bottom steel	.30
Marine steel	.40
Locomotive fire box steel	.50
Widths over 100 in. up to 110 in., inclusive	.05
Widths over 110 in. up to 115 in., inclusive	.10
Widths over 115 in. up to 120 in., inclusive	.15
Widths over 120 in. up to 125 in., inclusive	.25
Widths over 125 in. up to 130 in., inclusive	.50
Widths over 130 in.	1.00
Cutting to lengths or diameters under 3 ft. to 2 ft., inc.	.25
Cutting to lengths or diameters under 2 ft. to 1 ft., inc.	.50
Cutting to lengths or diameters under 1 ft.	1.55

No charge for cutting rectangular plates to lengths 3 ft. an over.

Wrought Pipe.—The following are the jobbers' carload discounts on the Pittsburgh basing card on steel pipe (full weight) in effect from January 1, 1913; iron pipe (full weight), from October 21, 1912:

Butt Weld.

Steel. Inches.	Black.	Galv.	Iron. Inches.	Black.	Galv.
⅛, ¼ and ⅜	73	52½	⅛ and ¼	67	48
½	77	66½	⅜	66	47
¾ to 3	80	71½	½	70	57
			¾ to 2½	73	62

Lap Weld.

2	77	68½	1¼	57	46
2½ to 6	79	70½	1½	68	57
7 to 12	76	65½	2	69	59
13 to 15	53	..	2½ to 4	71	62
			4½ to 6	71	62
			7 to 12	69	56

Plugged and Reamed.

1 to 3, butt	78	69½	1 to 1½, butt	71	60
2, lap	75	66½	2, butt	72	61
2½ to 4, lap	77	68½	1¼, lap	55	44
			1½, lap	66	55
			2, lap	67	57
			2½ to 4, lap	69	60

Butt Weld, extra strong, plain ends.

⅛, ¼ and ⅜	68	57½	⅜	64	53
½	73	66½	½	68	61
¾ to 1½	77	70½	¾ to 1½	72	63
2 to 3	78	71½	2 and 2½	73	64

Lap Weld, extra strong, plain ends.

2	74	65½	1½	66	60
2½ to 4	76	67½	2	67	59
4½ to 6	75	66½	2½ to 4	71	62
7 to 8	68	57½	4½ to 6	70	61
9 to 12	63	52½	7 and 8	64	54
			9 to 12	59	48

Butt Weld, double extra strong, plain ends.

¼	63	56½	½	58	50
⅜ to 1½	66	59½	¾ to 1½	61	53
2 to 2½	68	61½	2 to 2½	63	55

Lap Weld, double extra strong, plain ends.

2	64	57½	2	56	50
2½ to 4	66	59½	2½ to 4	61	55
4½ to 6	65	58½	4½ to 6	60	54
7 to 8	58	47½	7 to 8	53	43

The above discounts are subject to the usual variation in weight of 5 per cent. Prices for less than carloads are two (2) points lower basing (higher price) than the above discounts on black and three (3) points on galvanized.

Structural Material.—I-beams, 3 to 15 in.; channels, 3 to 15 in.; angles, 3 to 6 in., on one or both legs ¼ in. and over, and zees, 3 in. and over, 1.50c. to 1.75c. Extras on other shapes and sizes are as follows:

	Cents per lb.
I-beams over 15 in.	.05
H-beams over 18 in.	.05
Angles over 6 in.	.05
Angles, 3 in. on one or both legs, less than ¼ in. thick plus full extras, as per steel bar card, Sept. 1, 1909	.05
Tees, 3 in. and up	.05
Angles, channels and tees, under 3 in. plus full extras as per steel bar card, Sept. 1, 1909	.05
Deck beams and bulb angles	.30
Hand rail tees	.75
Checkered, trough and corrugated floor plates	.90

Extras for Cutting to Length.

Under 3 ft., to 2 ft. inclusive	.25
Under 2 ft., to 1 ft. inclusive	.50
Under 1 ft.	1.55

No charge for cutting to lengths 3 ft. and over.

Wire Rods and Wire.—Bessemer, open hearth and chain rods, $30. Fence wire, Nos. 0 to 9, per 100 lb., terms 60 days or 2 per cent. discount in 10 days, carload lots to jobbers, annealed, $1.55; galvanized, $1.95. Galvanized barb wire, to jobbers, $2.15; painted, $1.75. Wire nails to jobbers, $1.75.

The following table gives the price to retail merchants on fence wire in less than carloads, with the extras added to the base price:

Plain Wire, per 100 lb.

Nos.	0 to 9	10	11	12 & 12½	13	14	15	16
Annealed	$1.70	$1.75	$1.80	$1.85	$1.95	$2.05	$2.15	$2.25
Galvanized	2.10	2.15	2.20	2.25	2.35	2.45	2.85	2.95

Boiler Tubes.—Discounts on lap welded steel, in effect from January 1, 1913, and standard charcoal iron boiler tubes to jobbers in carloads are as follows:

Lap Welded Steel.		*Standard Charcoal Iron.*	
1¼ and 2 in.	61	1½ in.	46
2½ in.	58	1¾ to 2¼ in.	48
2½ and 2¾ in.	64	2½ in.	53
3 and 3¼ in.	69	2¾ to 3¼ in.	55½
3½ to 4½ in.	71	3½ to 5 in.	58
5 and 6 in.	64	Locomotive and steamship special grades bring higher prices.	
7 to 13 in.	61		

2½ in. and smaller, over 18 ft., 10 per cent. net extra.
2¾ in. and larger, over 22 ft., 10 per cent. net extra.
Less than carloads will be sold at the delivered discounts for carloads, lowered by two points for lengths 22 ft. and under to destinations east of the Mississippi River; lengths over 22 ft. and all shipments going west of the Mississippi River must be sold f.o.b. mill at Pittsburgh basing discount, lowered by two points.

Sheets.—Makers' prices for mill shipments on sheets of U. S. Standard gauge, in carload and larger lots, on which jobbers charge the usual advance for small lots from store, are as follows, f.o.b. Pittsburgh, terms 30 days net or 2 per cent. cash discount in 10 days from date of invoice:

Blue Annealed Sheets.

	Cents per lb.
Nos. 3 to 8	1.60 to 1.70
Nos. 9 and 10	1.65 to 1.75
Nos. 11 and 12	1.70 to 1.80
Nos. 13 and 14	1.75 to 1.85
Nos. 15 and 16	1.80 to 1.90

Box Annealed Sheets, Cold Rolled.

Nos. 10 and 11	1.90 to 2.00
No. 12	1.90 to 2.00
Nos. 13 and 14	1.95 to 2.05
Nos. 15 and 16	2.00 to 2.10
Nos. 17 to 21	2.05 to 2.15
Nos. 22 and 24	2.10 to 2.20
Nos. 25 and 26	2.15 to 2.25
No. 27	2.20 to 2.30
No. 28	2.25 to 2.35
No. 29	2.30 to 2.40
No. 30	2.40 to 2.50

Galvanized Sheets of Black Sheet Gauge.

Nos. 10 and 11	2.40 to 2.50
No. 12	2.50 to 2.60
Nos. 13 and 14	2.50 to 2.60
Nos. 15 and 16	2.65 to 2.75
Nos. 17 to 21	2.80 to 2.90
Nos. 22 and 24	2.95 to 3.05
Nos. 25 and 26	3.10 to 3.20
No. 27	3.25 to 3.35
No. 28	3.40 to 3.50
No. 29	3.55 to 3.65
No. 30	3.70 to 3.80

The Boydell Bros. White Lead & Color Company, Detroit, Mich., for some years has held an annual banquet, tendered to some 50 or more of its heads of departments and other employees. The custom was continued on the evening of December 26 at the Berghoff Hotel. After-dinner speeches were made by department heads which mingled some sound business suggestions with good humor. After the banquet those in attendance, with the addition of their wives, formed a theater party.

Pittsburgh

PITTSBURGH, PA., December 31, 1912.

The steel makers are much gratified with the strength of the market and also with the way in which the new demand has kept up during what is usually a dull period, while specifications are reported as coming in in almost as heavy volume as at any time in the past three or four months. Two steel interests report their orders for last week as much heavier than a year ago. Few steel manufacturers have any material to sell for delivery in first half and most of the contracts now being placed are for third and fourth quarter. Prompt coke is higher, while the scrap market is looking better.

Pig Iron.—The Youngstown Sheet & Tube Company, Youngstown, Ohio, has bought 50,000 tons of basic iron and 20,000 tons of Bessemer from the Ohio Iron & Steel Company for delivery in second half of 1913, also 12,500 tons of Bessemer from the Andrews & Hitchcock Iron Company and 4400 tons of Bessemer from the Sharpsville Furnace Company. All the Bessemer iron was on the basis of about $17.25 at Valley furnace while the basic iron was in the nature of a conversion deal, the Youngstown Sheet & Tube Company furnishing 100,000 tons of non-Bessemer ore to the Ohio Iron & Steel Company which it will convert into basic pig iron for the buyer. The Ohio Iron & Steel Company still owes the Youngstown Sheet & Tube Company 44,000 tons of pig iron on a former contract, and as soon as delivery of this is completed the former will start on the new contract. The entire product of the Ohio Iron & Steel Company is practically sold up to the Youngstown Sheet & Tube Company for all of next year. There is a fair amount of new inquiry for pig iron, but mostly in small lots for spot shipment. Consumers are taking out iron very promptly, in some cases asking the furnaces to anticipate deliveries. We quote standard Bessemer iron for first half delivery at $17.25; basic, $16.50; No. 2 foundry, $17.50 to $18; malleable Bessemer, $17 to $17.25; gray forge, $16.25 to $16.30, all at Valley furnace, the freight rate for delivery in the Pittsburgh district being 90c. a ton.

Steel Billets.—It is learned that the recent purchase of the Carnegie Steel Company of 15,000 tons of open hearth billets was made from the Southern Iron & Steel Company, Birmingham, Ala., and a part of the tonnage will probably be shipped to Pencoyd, Pa., by rail and water delivery. We note a sale of 2000 tons of open hearth billets rolled to specifications at $29, Pittsburgh, for January and February delivery, and about 1500 tons of sheet bars for first quarter at $28.50 Youngstown, this steel coming to Pittsburgh, and costing the buyer $29.50 delivered. Prices are very strong and we quote: Bessemer billets, $27.50; Bessemer sheet bars, $28; open hearth billets, $28.50 to $29, and open hearth sheet bars, $29 to $29.50, f.o.b. mill, Pittsburgh or Youngstown, Ohio. Forging billets are ruling at $35 or higher, and axle billets at $33 to $34, Pittsburgh.

Ferroalloys.—New inquiry is quiet, but the market is very strong. We note sales of three carloads of about 90 tons of English 80 per cent. ferromanganese for prompt delivery at $75, Pittsburgh. We quote 80 per cent. English ferromanganese for first half at $68 to $70; for second half, $65, and for spot shipment, $75, all f.o.b. Baltimore, the rate to Pittsburgh being $1.95 a ton. We quote 50 per cent. ferrosilicon, in lots up to 100 tons, at $75; over 100 tons to 600 tons, $74; over 600 tons, $73, Pittsburgh. We quote 10 per cent. at $24; 11 per cent., $25; 12 per cent., $26, f.o.b. cars at furnace, Jackson, Ohio, or Ashland, Ky. We quote ferrotitanium at 8c. per lb. in carloads; 10c. in 2000-lb. lots and over and 12½c. in lots up to 2000 lb.

Steel Rails.—It is understood that the Nickel Plate has placed a contract for 5000 tons of 85-lb. steel rails with the Carnegie Steel Company. New demand for light rails continues active, the Carnegie Steel Company having received new orders and specifications in the past week for over 5000 tons. We quote splice bars at 1.50c. per lb. and standard section rails at 1.25c. per lb. Light rails are quoted as follows: 25, 30, 35, 40 and 45-lb. sections, 1.25c.; 16 and 20 lb., 1.30c.; 12 and 14-lb., 1.35c., and 8 and 10-lb., 1.40c., all in carload lots, f.o.b. Pittsburgh.

Wire Rods.—Specifications against contracts are active and prices firm. We quote Bessemer, open hearth and chain rods at $30, Pittsburgh.

Muck Bar.—The market is very dull but prices on standard grade, made from all pig iron, are fairly strong at $31, Pittsburgh.

Skelp.—A local pipe mill bought in the past week 4000 to 5000 tons of grooved skelp for delivery in first quarter at 1.45c., Pittsburgh. We quote grooved skelp at 1.45c. to 1.50c.; sheared steel skelp, 1.50c. to 1.55c.; grooved iron skelp, 1.75c. to 1.80c.; sheared iron skelp, 1.85c. to 1.90c., delivered at buyers' mills in the Pittsburgh district.

Plates.—New orders for steel cars continue active, the Illinois Central having placed 2500 all-steel gondola cars and 500 flat cars, and is inquiring for 1000 more gondolas, 50 stock cars, 800 furniture cars, 500 refrigerator cars, 500 fruit cars and 70 cabooses. The Norfolk & Western has placed 500 box cars with the Mount Vernon Car Mfg. Company and 500 steel stock cars with the Ralston Steel Car Company. The Chicago, Burlington & Quincy has placed 2000 more freight cars with the Haskell & Barker Car Company. William M. Duncan, receiver of the Wheeling & Lake Erie Railroad, has been given authority to purchase 1300 freight cars and 20 locomotives. We quote ¼-in. and heavier tank plates at 1.45c. to 1.50c., Pittsburgh, for delivery at convenience of the mill, which would be not before second quarter and possibly third quarter, while for delivery in four to six weeks from 1.55c. to 1.60c. is quoted, and for shipment in two weeks, 1.75c. to 1.80c. can be had.

Structural Material.—New inquiry has been quite active. The American Bridge Company has taken 400 tons of steel for a new building for the American Vanadium Company at Knoxville, Tenn., and the McClintic-Marshall Construction Company 900 tons of bridge work for a Western railroad. We quote beams and channels up to 15-in. at 1.45c. to 1.50c., for delivery at the convenience of the mill, while small lots for delivery in two to four weeks are bringing from 1.75c. to 2c. or higher.

Car Wheels.—Liberal orders are being placed and some heavy inquiries are sent out. We quote 33-in. wheels for freight service at $15 to $15.50 and 36-in. for passenger cars at $19 to $19.50 per wheel, f.o.b. Pittsburgh.

Iron and Steel Bars.—None of the leading steel bar mills has any tonnage of consequence to sell for delivery in third or fourth quarters. The new demand for iron bars is also very active. We quote merchant steel bars at 1.40c. to 1.45c. for delivery at convenience of the mill, while for fairly prompt shipment 1.60c. to 1.75c. is paid by consumers. We quote iron bars at 1.70c. to 1.75c. for reasonably prompt shipment. Mills charge $1 extra per ton for twisting ¼-in. and larger steel bars and $2 extra for ½ to ⅝ in.

Sheets.—Very heavy contracts are being placed by jobbers and consumers for second quarter delivery and few sheet mills have any of their output to sell for delivery in first quarter. The American Sheet & Tin Plate Company is operating to about 80 per cent. of its hot sheet mill capacity. All the mills are handicapped by the shortage in steel, which is getting more acute. The market is strong on the basis of 1.65c. for Nos. 9 and 10 blue annealed sheets, 2.25c. for No. 28 black sheets and 3.40c. for No. 28 galvanized.

Tin Plate.—It is predicted that there will be a shortage in supply of tin plate for first and second quarters on account of the scarcity of steel and the very heavy contracts taken by the mills for delivery in first half. There are reports of an early advance in the price of tin plate. The market is strong. We quote 100 lb. cokes at $3.60 and 100 lb. ternes $3.45 f.o.b. Pittsburgh.

Spelter.—The market is dull and prices are rather weak. We quote prime grades of Western at 7.15c. East St. Louis, equal to 7.27½c., Pittsburgh.

Railroad Spikes.—The new demand is quiet, but specifications are coming in very freely and makers have their product sold up through first quarter. We quote railroad spikes in base sizes, 5½ x 9/16 in., at $1.90, and small railroad and boat spikes at $1.90 and $2 per 100 lb., f.o.b. Pittsburgh, for forward delivery. Small spikes have sold as high as $2.25 for prompt shipment.

Hoops and Bands.—Specifications against contracts are coming in freely, but new demand is quiet as consumers are covered. We quote steel bands at 1.45c. to 1.50c., with extras as per the steel bar card, and hoops at 1.50c., Pittsburgh, for shipment over first half.

Shafting—An advance in prices of about two points is expected to be made in a few days. The new demand is dull, but consumers are specifying very freely against contracts.

Merchant Steel.—Consumers are specifying very actively on contracts, but the new demand has quieted down very much. We quote: Iron finished tire, 1½ x ⅜ in. and larger, 1.40c. to 1.55c., base; under 1½ x ⅜ in.,

to 1.65c.; planished tire, 1.60c. to 1.70c.; channel ⅜ and 1 in., 1.90c. to 2c.; 1⅛ in. and larger, 1.80c. 2c.; toe calk, 2c. to 2.10c., base; flat sleigh shoe, to 1.65c.; concave and convex, 1.80c. to 1.90c.; cut- 2c. tapered or bent, 2.30c. to 2.40c.; spring steel, 2c. 10c.; machinery steel, smooth finish, 1.80c. to 1.85c. quote cold rolled strip steel as follows: Base rates in. and 1½ in. and wider, under 0.20 carbon, and to and heavier, hard temper, 3.30c.; soft, 3.55c.; hard, 3.20c.; soft, 3.45c.; freight allowed. The differentials apply for lighter gauges and sizes.

Merchant Pipe.—The December demand was much heavier than in the same month last year, and specifications are still coming into the mills very freely. Some very large gas and oil projects are under way, and the outlook is that there will be an enormous demand for line pipe in 1913. One very large contract involving 300 to 400 miles of large sizes of pipe is expected to be placed this week.

Boiler Tubes.—Railroads and other consumers of boiler tubes are specifying very freely against contracts but new demand is quiet. The new discounts are reported as being firmly held.

Bolts and Rivets.—The new demand has fallen off to some extent, as consumers are well covered ahead. We quote button head structural rivets at $2.20 and cone head boiler rivets at $2.30 per 100 lb. The discounts on bolts are as follows, in lots of 300 lb. or over, delivered within a 20c. freight radius of maker's works:

Coach and lag screws	80 and 10% off
Small carriage bolts, cut threads	75 and 5% off
Small carriage bolts, rolled threads	75 and 10% off
Large carriage bolts	70% off
Small machine bolts, rolled threads	75, 10 and 5% off
Small machine bolts, cut threads	75 and 10% off
Large machine bolts	70 and 7% off
Machine bolts with C.P.C. and T nuts, small	75 and 5% off
Machine bolts with C.P.C. and T nuts, large	70% off
Square hot pressed nuts, blanked and tapped	$5.70 off list
Hexagon nuts	$6.30 off list
C.P.C. and R. square nuts, tapped and blank	$5.70 off list
Hexagon nuts ⅝ and larger	$6.60 off list
Hexagon nuts smaller than ⅝	$7.20 off list
C.P. plain square nuts	$5.20 off list
C.P. plain hexagon nuts	$5.50 off list
Semi-finished hexagon nuts ⅝ and larger	85% off
Semi-finished hex. nuts smaller than ⅝	85 and 10% off
Rivets, 7/16 x 6½, smaller and shorter	75, 10 and 10% off
Rivets, metallic tinned, bulk	3½c. per lb. net extra
Rivets, tin plated, bulk	1½c. per lb. net extra
Rivets, metallic tinned, packages	70, 10 and 10% off

Wire Products.—This is the dull season in the wire trade, and therefore inquiry is light, but jobbers and consumers are specifying freely against contracts. We quote wire nails at $1.75 per keg; cut nails, $1.70 per keg; galvanized barb wire, $2.15 per 100 lb.; painted, $1.75; annealed fence wire, $1.55, and galvanized fence wire, $1.95, f.o.b. Pittsburgh, usual terms, freight added to point of shipment. Jobbers charge the usual advances for small lots from store.

Iron and Steel Scrap.—Dealers report that the scrap trade is picking up in demand on material for delivery later this month and in February. Prices on heavy steel scrap are a little better. A local consumer is reported to have bought about 1000 tons of selected grades of steel scrap at about $15.25 delivered. Dealers quote, per gross ton, as follows:

Heavy steel scrap, Steubenville, Follansbee, Brackenridge, Sharon, Monessen and Pittsburgh delivery	$15.00 to $15.25
No. 1 foundry cast	14.50 to 14.75
No. 2 foundry cast	13.50 to 13.75
Bundled sheet scrap, f.o.b. consumers' mills, Pittsburgh district	12.75 to 13.00
Rerolling rails, Newark and Cambridge, Ohio, Cumberland, Md., and Franklin, Pa.	16.25 to 16.50
No. 1 railroad malleable stock	14.25 to 14.50
Grate bars	10.75 to 11.00
Low phosphorus melting stock	18.00 to 18.25
Iron car axles	24.25 to 24.75
Steel car axles	17.75 to 18.00
Locomotive axles, steel	21.75 to 22.00
Locomotive axles, iron	27.75 to 28.00
No. 1 busheling scrap	14.25 to 14.50
No. 2 busheling scrap	9.75 to 10.00
Old car wheels	15.75 to 16.00
*Cast iron borings	10.00 to 10.25
*Machine shop turnings	10.50 to 10.75
†Steel bar crop ends	16.50 to 16.75
Old iron rails	16.25 to 16.50
No. 1 railroad wrought scrap	15.00 to 15.25
Heavy steel axle turnings	12.75 to 13.00
Stove plate	10.75 to 11.00

*These prices are f.o.b. cars at consumers' mills in the Pittsburgh district.
†Shipping point.

Coke.—Some coke works have not drawn any coke for four or five days on account of the holidays, and the shortage in supply of prompt furnace coke is more acute. Prices are higher. A local coke interest reports having taken a contract for 12,000 tons of standard furnace coke for first half delivery at $3.50 per net ton at oven. We note sales of about 3000 tons of prompt furnace coke at $4.10 to $4.25 at oven. There is a good deal of inquiry for furnace coke for first half, some furnaces not yet having covered. We quote standard makes of furnace coke for spot shipment at $4.15 to $4.25 per net ton at oven. Contract furnace coke is held at about $3.25, with one or two dealers still asking $3.50. Foundry coke for prompt shipment is strong at $4.50 to $4.75; on contracts $3.75 up to $4 per net ton at oven is quoted.

Cleveland

CLEVELAND, OHIO, December 30, 1912.

Iron Ore.—With one exception, all the ore firms have covered for about all the vessel capacity they will need for the coming season. One firm that attempted to secure carrying capacity on the last season's basis, 5c. a ton lower than the present rate, came into the market for considerable tonnage at the advanced rate. It is estimated that vessel capacity has been chartered for moving 42,000,000 to 45,000,000 tons of ore, this including the vessel tonnage controlled by the shippers themselves. No ore sales are reported, but sellers expect some activity after the holidays. We quote prices as follows: Old range Bessemer, $4.40; Mesaba Bessemer, $4.15; Old range non-Bessemer, $3.60, and Mesaba non-Bessemer, $3.40.

Pig Iron.—That the market is not entirely lifeless is indicated by the fact that one local interest has sold about 2000 tons of foundry iron in small lots in the past few days for first half delivery. Much of this went to consumers who had previously covered for expected requirements but found themselves needing additional iron. Foundries continue to crowd furnaces for shipments and some ask that shipments be anticipated. Some delay in deliveries is being caused by a scarcity in cars. The market is very firm at $17.50, furnace, for No. 2 foundry for local delivery or outside shipment. Consumers in this territory have not yet come in the market with inquiries for last half. Ohio silvery iron for early delivery is very scarce. For prompt shipment and for the first half of 1913 we quote, delivered Cleveland, as follows:

Bessemer	$18.15 to $18.40
Basic	17.40 to 17.75
Northern No. 2 foundry	17.75 to 18.00
Southern No. 2 foundry	18.35 to 18.85
Gray forge	17.25 to 17.50
Jackson County silvery, 8 per cent. silicon	20.55 to 21.55

Coke.—The market is very firm but the only sales reported are a few lots of foundry at $4.50 for prompt shipment. Standard Connellsville furnace coke is quoted at $4 to $4.25 per net ton at oven for spot shipment and $3.25 to $3.50 for the first half. Standard 72 hour foundry coke is held at $4.50 to $4.75 for prompt shipment and $4.25 to $4.50 for contract.

Finished Iron and Steel.—While the demand has fallen off considerably it has been heavier than usual during the holiday season. There has been a fair volume of new inquiry for reinforcing bars, plates and structural shapes for specific work for delivery early in the spring, but buyers are having trouble in getting material for the delivery wanted. New inquiries for steel for construction work are coming out earlier than usual because of the congested condition of the mills. The holiday shut down for inventories has been dispensed with by local mills on account of the heavy volume of orders on hand. In structural lines considerable work is pending, but the placing of contracts is being deferred until after the holidays. While the demand for material for early delivery is less active than a few weeks ago, Eastern mills continue to take orders in this market for structural material at 1.65c. and plates at 1.60c. to 1.65c. for delivery in from 30 to 90 days. The demand for sheets continues active and the market is very firm. Some of the mills are taking orders at 2.35c. for No. 28 black, 3.50c. for No. 28 galvanized and 1.70c. to 1.75c. for No. 10 blue annealed for delivery in about 60 days. Eastern mills are quoting forging billets for early delivery at $35 at mill, but buyers have been able to secure carload lots at somewhat lower prices from Central Western mills. Rivets are firm at 2.20c. for structural and 2.30c. for boiler; the demand is heavy and a local maker is well filled with first half tonnage at this price. Bar iron is firm at 1.60c., Cleveland; the warehouse demand shows little falling off. Local warehouse prices are unchanged at 2.10c. for steel bars and 2.25c. for plates and structural material.

Old Material.—Owing to the fact that the mills are taking inventory they are at present accepting very little scrap on contract. Because of recent heavy ship-

ments they have fairly good stocks on hand. There is practically no inquiry for future delivery. The market is not firm but quotations are unchanged except on heavy steel. A local dealer reports a sale of a small tonnage of new railroad heavy steel scrap at $14, but for yard stocks the maximum quotation is $13.50. We quote, f.o.b. Cleveland, as follows:

Per Gross Ton.

Old steel rails, rerolling	$15.00 to $15.50
Old iron rails	17.50 to 18.00
Steel car axles	18.75 to 19.25
Heavy melting steel	13.25 to 13.50
Old car wheels	14.50 to 15.00
Relaying rails, 50 lb. and over	23.00 to 23.50
Agricultural malleable	12.50 to 13.00
Railroad malleable	14.00 to 14.50
Light bundled sheet scrap	12.50 to 13.00

Per Net Ton.

Iron car axles	$21.00 to $22.00
Cast borings	7.75 to 8.00
Iron and steel turnings and drillings	8.00 to 8.50
Steel axle turnings	9.25 to 9.50
No. 1 busheling	11.50 to 12.00
No. 1 railroad wrought	13.50 to 14.00
No. 1 cast	13.00 to 13.50
Stove plate	10.00 to 10.50
Bundled tin scrap	11.00 to 11.50

Chicago

CHICAGO, ILL., December 31, 1912, *By Telegraph.*

The Duluth, Missabe & Northern Railroad has placed with the American Bridge Company the contract for 22,000 tons of steel for a new ore dock and the Marshall Field estate has arranged for one building to require 7000 tons. December orders and specifications for steel products will rank in total tonnage with the largest months of the year in this territory. The consideration of first quarter shipments on new business in all of the finished lines is being urged upon producers. The aggregate tonnage of car steel pending is the largest in the market at any time during the year.

Pig Iron.—The demand for Southern iron is confined to the few available cars of spot iron which are moved at the prevailing price of $14, Birmingham. The movement in Northern iron, though somewhat heavier, is still rather quiet. The inquiry for 6000 tons of charcoal iron mentioned last week has been closed by the Michigan City car builder. We quote local irons, f.o.b. furnace, the average switching charge to Chicago foundries being about 50c. a ton. Other quotations are for Chicago delivery. Prices on prompt shipment are as follows:

Lake Superior charcoal, Nos. 1, 2, 3, 4	$18.75 to $19.75
Northern coke foundry, No. 1	18.50 to 18.75
Northern coke foundry, No. 2	18.00 to 18.25
Northern coke foundry, No. 3	17.50 to 18.00
Southern coke, No. 1 foundry and No. 1 soft	18.85 to 19.35
Southern coke, No. 2 foundry and No. 2 soft	18.35 to 18.85
Southern coke, No. 3	17.85 to 18.35
Southern coke, No. 4	17.35 to 17.85
Southern gray forge	17.35 to 17.85
Southern mottled	16.85
Malleable Bessemer	18.00 to 18.25
Standard Bessemer	19.40 to 19.90
Basic	17.75 to 18.25
Jackson Co. and Kentucky silvery, 6 per cent	20.40
Jackson Co. and Kentucky silvery, 8 per cent	21.40
Jackson Co. and Kentucky silvery, 10 per cent	22.40

Structural Material.—The contract for 22,000 tons of steel placed by the Duluth, Missabe & Northern Railroad with the American Bridge Company is one of the largest of the year. A Marshall Field estate building requiring 7000 tons was also placed. Other contracts reported aggregated nearly 4000 tons. We quote for Chicago delivery from mill, on plain shapes, 1.63c.

Quotations from warehouse are unchanged at $2.05.

(By Mail)

Rivets and Bolts.—The price for rivets is apparently quite firmly established at 2.38c., Chicago, despite the fact that a spread of 75c. per 100 lb. is thus made over bars. Deliveries on bolts and nuts have improved so that the trade in general is being provided for in a better manner. We quote from mill as follows: Carriage bolts up to ⅜ x 6 in. rolled thread, 75-10; cut thread, 75-5; larger sizes, 70-2½; machine bolts up to ⅜-in. x 4 in., rolled thread, 75-10-5; cut thread, 75-10; large sizes, 70-7½; coach screws, 80-10; hot pressed nuts, square head, $5.70 off per cwt.; hexagon, $6.30 off per cwt. Structural rivets, ¾ to 1¼ in., 2.38c., base, Chicago, in carload lots; boiler rivets, 0.10c. additional.

Out of store we quote for structural rivets, 2.70c., and for boiler rivets, 2.90c. Machine bolts up to ⅜ x 4 in., 70-7½; larger sizes, 65-5, carriage bolts up to ⅜ x 6 in., 70-5; larger sizes, 65 off. Hot pressed nuts, square head, $5.30, and hexagon, $5.90 off per cwt.

Wire Products.—The usual holiday interval for mill repairs will be reduced this year to a minimum in view of the depleted warehouse stocks and the prospects for heavy spring trade. Prices are firm for all of the various wire products, and we quote as follows; Plain wire, No. 9 and coarser, base, $1.73; wire nails, $1.93; painted barb wire, $1.93; galvanized, $2.33; polished staples, $1.93; galvanized, $2.33, all Chicago.

Rails and Track Supplies.—Current activity in rails and track fastenings is almost entirely in the nature of specifications on contracts. We quote standard railroad spikes at 1.95c. to 2.05c., base; track bolts with square nuts, 2.30c. to 2.40c., base, all in carload lots, Chicago; tie plates, $32 to $34.50 net ton; standard section Bessemer rails, Chicago, 1.25c., base; open hearth, 1.34c.; light rails, 25 to 45 lb., 1.25c.; 16 to 20 lb., 1.30c.; 12 lb., 1.35c.; 8 lb., 1.40c.; angle bars, 1.50c., Chicago.

Plates.—At no time during the year has the tonnage involved in car inquiries pending and in orders recently placed with car builders been larger than at present. Jobbers also are urging upon the mills a more liberal provision for their requirements during 1913. We quote for Chicago delivery, mill shipment, 1.63c.

From store we continue to quote, for base sizes, 2.05c.

Bars.—For both iron and steel bars a considerable tonnage of new business is available if the mills could accommodate the trade. We quote for mill shipment as follows: Bar iron, 1.57½c. to 1.60c.; soft steel bars, 1.58c. to 1.65c.; hard steel bars, 1.60c. to 1.70c.; shafting in carloads, 60 per cent. off; less than carloads, 55 per cent. off.

For delivery from store, we quote soft steel bars, 1.95c.; bar iron, 1.95c.; reinforcing bars, 1.95c. base with 5c. extra for twisting in sizes ¾ in. and over, and 7½c. extra for smaller sizes; shafting, 55 per cent. off.

Sheets.—Inquiries from manufacturers and jobbers concerning additional tonnages are surprisingly numerous, and from the outlook an active first quarter seems assured. We quote for Chicago delivery in carloads from mill: No. 28 black sheets, 2.43c. to 2.53c.; No. 28 galvanized, 3.58c. to 3.68c.; No. 10 blue annealed, 1.83c. to 1.88c.

For sheets out of store we quote as follows: No. 10 blue annealed, 2.25c.; No. 28 black, 2.80c., and No. 28 galvanized, 4.05c.

Cast Iron Pipe.—A considerable number of the smaller towns have under consideration the improvement of their waterworks systems, and a large aggregate of such tonnage is expected to materialize in January and February. We quote as follows, per net ton, Chicago: Water pipe, 4 in., $31; 6 to 12 in., $29; 16 in., and up, $28, with $1 extra for gas pipe.

Old Material.—The congestion in the handling of cars at consumers' plants in Chicago suburbs still obtains, one large melter having over 100 cars on track at the works and 200 additional en route. The embargos existing have had a demoralizing influence on the strength of local scrap prices, and apparently material improvement is not yet in sight. We quote for delivery at buyers' works, Chicago and vicinity, all freight and transfer charges paid, as follows:

Per Gross Ton.

Old iron rails	$17.25 to $17.75
Old steel rails, rerolling	16.25 to 16.75
Old steel rails, less than 3 ft.	14.50 to 15.00
Relaying rails, standard section, subject to inspection	24.00
Old car wheels	17.25
Heavy melting steel scrap	12.50 to 13.00
Frogs, switches and guards, cut apart	12.75 to 13.00
Shoveling steel	12.50 to 12.75
Steel axle turnings	11.00 to 11.50

Per Net Ton.

Iron angles and splice bars	$16.00 to $16.50
Iron arch bars and transoms	16.50 to 17.00
Steel angle bars	12.50 to 13.00
Iron car axles	21.50 to 22.00
Steel car axles	18.00 to 18.50
No. 1 railroad wrought	12.75 to 13.25
No. 2 railroad wrought	12.25 to 12.75
Cut forge	12.25 to 12.50
Steel knuckles and couplers	12.75 to 13.25
Steel springs	13.25 to 13.75
Locomotive tires, smooth	14.00 to 14.50
Machine shop turnings	8.00 to 8.50
Cast and mixed borings	6.75 to 7.25
No. 1 busheling	11.25 to 11.75
No. 2 busheling	8.25 to 8.75
No. 1 boilers, cut to sheets and rings	9.50 to 10.00
Boiler punchings	12.50 to 13.00
No. 1 cast scrap	13.00 to 13.50
Stove plate and light cast scrap	10.75 to 11.25
Railroad malleable	13.50 to 14.00
Agricultural malleable	11.75 to 12.25
Pipes and flues	10.00 to 10.50

Philadelphia

PHILADELPHIA, PA., December 30, 1912.

Activity in low grade foundry and low phosphorus pig iron continues and makers of heavy steel plates find no diminution in the volume of business offered. Other lines are quiet but prices are strong. Constant heavy pressure for deliveries has restricted the usual holiday and year end suspension of mills. With the majority Christmas day alone was observed. Specifications in all lines of rolled products have been heavy, and there will be practically no cancellation of unfilled orders unspecified December 31. Coke has been quieter. The old material market has been dull, with prices in principal grades weak.

Iron Ore.—Definite tonnages arranged for during the week with consumers in this district have brought the total sales of Wabana ore for next season to 240,000 tons, the full American allotment on the present production basis, although a greater amount may be available if estimates are exceeded. This increases the recently reported sales by 40,000 tons. Sales of Wabana to European buyers for 1913 shipment will total 200,000 tons, and German consumers stand ready to take any surplus production at ½c. a unit above selling prices in the American market.

Pig Iron.—Notwithstanding customary year end dullness a very fair business has been moving in the higher foundry and special grades. Sales have been mostly in small lots for early shipment and the market continues very firm. Some producers are sold up for the next 30 to 60 days and can only accept forward business, but few orders involving delivery beyond the first quarter have been taken. Standard brands of eastern Pennsylvania No. 2 X foundry are firm at $18.50, delivered, as a minimum and higher prices are frequently obtained. Light sales of Virginia No. 2 X continue to be made for first quarter shipment at $16 at furnace. Activity continues in low grade pig iron. One Delaware River consumer has an inquiry out for 7500 tons for second quarter, while another has been negotiating for 5000 tons of Southern iron. Sales of moderate lots of off grade have been made to pipe makers by different sellers at various prices, depending on analysis. Rolling mill forge is quiet, although a recent large buyer will again come into the market in the near future. While there has been no movement in basic iron considerable business has been closed in the past few days in low phosphorus, both in small and large lots, for prompt as well as forward shipment. Standard analysis low phosphorus iron is now flatly on a $24.50 delivered basis. Sales of several lots of Bessemer iron, one at $21 and another at $21.50, delivered, are announced. Consumers are still urging deliveries on orders, and furnaces, owing to depleted stocks, find it difficult to meet demands. Quotations for standard brands, delivered in buyers' yards in this district, for first quarter and half, are about as follows:

Eastern Pennsylvania No. 2 X foundry	$18.50 to $18.75
Eastern Pennsylvania No. 2 plain	18.25 to 18.50
Virginia No. 2 X foundry	18.80 to 19.00
Virginia No. 2 plain	18.55 to 18.75
Gray forge (nominal)	17.75
Basic	18.25
Standard low phosphorus	24.50

Ferroalloys.—Little new inquiry for 80 per cent. ferromanganese has developed. No sales have been reported in this district and the price situation is nominally unchanged, at $75 seaboard for prompt lots; $67 to $70 for first half, and $65 for last half. Carload sales of 50 per cent. ferrosilicon have been made at $75 delivered here. Furnace ferrosilicon is quiet, with prices unchanged.

Billets.—Mills observed but a single day holiday last week, endeavoring to keep up with customers' urgent demand for delivery. Considerable large lot business for 1913 delivery is still pending, but the mills are so well supplied with orders that little haste in entering new business is shown. Prompt billets are scarce and when available command several dollars a ton premium. Basic open hearth rolling billets for first half command $32 delivered, while ordinary forging billets are firm at $36 minimum, at Eastern mill.

Plates.—A very good run of new orders is reported while specifications are heavy. Mills will carry no unspecified tonnage over on contracts expiring with the year end. Some are refusing to make contracts for any delivery; others enter first quarter business at current prices, but are not taking business for more extended delivery. Numerous inquiries for boat, car and bridge steel are still before the trade. Prices are very firm and the tendency, at least on the part of one important Eastern producer, is toward higher figures. For first quarter delivery in this district sheared plates are quoted at 1.75c. and universal plates 1.80c., although extended forward business can still be entered with Western mills at 1.65c. delivered here.

Structural Material.—A fair volume of miscellaneous business has been booked. Specifications are being prepared for several moderate sized bridges by Eastern railroads, and some fair building propositions are in sight. The mills are fully engaged and fabricators are busy but handicapped by inability to get satisfactory deliveries on plain material. Prices range from 1.65c. for uncertain forward shipment to 1.75c. for first quarter, delivered in this district, with prompt shipments, when available, ranging from 1.80c. to 2c., Eastern mill.

Sheets.—With second quarter order books open, Eastern mills have entered a considerable volume of new business. First quarter capacity has been practically taken. Operations at mills were largely suspended during the week for repairs and stocktaking, but full capacity operations now rule. Western sheets are scarce and strong at 1.90c., delivered here, on No. 10 blue annealed, while Eastern mills, making smooth loose-rolled sheets readily obtain 2.05c. for early shipments.

Bars.—Current business has been seasonably small. Mills have been giving some attention to the holiday and annual inventories and operations have therefore been irregular. The general market for iron and steel bars is firm and prices are unchanged, common iron bars being quoted at 1.67½c. to 1.77c. for extended and 1.75c. to 2c. for prompt deliveries. Steel bars are scarce at 1.85c. for early delivery, while for extended shipment 1.55c. to 1.60c. continues to be quoted.

Coke.—Negotiations are pending for moderate lots of January and first quarter furnace coke, although little business has been closed. There is still some irregularity regarding prices and buyers are cautious. Several 1000-ton lots of standard furnace coke, for first quarter, have been sold at $3.75 at oven. Foundry coke has been quiet, with prices unchanged. The following range of quotations, per net ton, is named for delivery in this territory:

Connellsville furnace coke	$5.00 to $5.75
Connellsville foundry coke	5.85 to 6.50
Mountain furnace coke	4.50 to 5.00
Mountain foundry coke	5.60 to 6.10

Old Material.—Dullness characterizes the market. The business moving has been largely of the forced sale class. Steel mills are well covered for near future requirements and are not disposed to pay top prices, even for extended shipments. At least one large consumer has ordered deliveries against contracts curtailed. Rolling mill grades are practically at a standstill. Little movement is expected until after the turn of the year. Prices are irregular and quotations largely nominal. The following range about represents the market for deliveries in buyers' yards, in this district, covering eastern Pennsylvania and nearby points, taking a freight rate varying from 35c. to $1.35 per gross ton, range about as follows:

No. 1 heavy melting steel	$14.50 to $15.00
Old steel rails, rerolling (nominal)	17.00 to 17.50
Low phosphorus heavy melting steel scrap	18.50 to 19.00
Old steel axles	20.00 to 20.50
Old iron axles (nominal)	26.00 to 27.00
Old iron rails	18.00 to 18.50
Old car wheels	16.00 to 16.50
No. 1 railroad wrought (nominal)	16.25 to 16.75
Wrought iron pipe	13.50 to 14.00
No. 1 forge fire	13.50 to 14.00
No. 2 light iron (nominal)	8.00 to 8.50
Wrought turnings	11.00 to 11.50
Cast borings	10.75 to 11.25
Machinery cast	15.00 to 15.50
Grate bars, railroad	11.50 to 12.00
Stove plate	11.50 to 12.00
Railroad malleable (nominal)	13.50 to 14.00

Cincinnati

CINCINNATI, OHIO, December 30, 1912.

Pig Iron.—The market has the usual holiday doldrums, although there has been some buying of small lots to fill in on nearby requirements, and one Western buyer of Southern iron considered it the right time to come in for a round lot to be shipped during the first half. As a whole, the month of December has shown a big improvement over the corresponding month of 1911, both in point of price and tonnage placed. The Southern price situation is stronger, and $14 is the recognized quotation for the first quarter, but this same figure is also available for delivery through the first half. Southern Ohio No. 2 foundry, basic and malleable are all firm at $17, Ironton, for

first half. On account of the scarcity of coke and the consequent high prices asked for it, the Hanging Rock furnace operators are indifferent about booking any large additional tonnages; as a matter of fact, several producers in that district are unable to take on any business for delivery during the first quarter. Based on freight rates of $3.25 from Birmingham, and $1.20 from Ironton, we quote f.o.b. Cincinnati, as follows:

Southern coke, No. 1 foundry and 1 soft	$17.50 to $17.75
Southern coke, No. 2 foundry and 2 soft	17.25 to 17.50
Southern coke, No. 3 foundry	17.00 to 17.25
Southern, No. 4 foundry	16.75 to 17.00
Southern gray forge	16.50 to 16.75
Old silvery, 8 per cent. silicon	20.20 to 20.70
Southern Ohio coke, No. 1	18.70 to 19.20
Southern Ohio coke, No. 2	18.20 to 18.70
Southern Ohio coke, No. 3	17.95 to 18.45
Southern Ohio malleable Bessemer	17.70 to 18.20
Basic, Northern	18.20 to 18.70
Lake Superior charcoal	19.25 to 19.75
Standard Southern car wheel	27.25 to 27.75

Coke.—The situation continues very acute, especially as regards furnace coke. Four different blast furnaces in the Ironton district have been compelled to operate intermittently of late, due to an inability to secure a supply of coke, and a spell of bad weather would make the situation worse. However, in the face of this condition, the contract price of 48-hr. coke, for first half shipment, is around $3.25 to $3.50, per net ton at oven, in all three fields, but for strictly first quarter delivery it would be difficult to place any good-sized order at even the last figure named. Prompt shipment coke is still bringing a high premium, and 48-hr. brands are sold all the way from $3.75 to $4.50. Foundry coke is only bringing an average of 25c. a ton above furnace coke quotations.

Old Material.—The market continues stagnant, and no change is anticipated until well along in January. While prices are still weak, there is not enough being sold to warrant a change in previous quotations. The minimum figures given below represent what buyers are willing to pay for delivery in their yards, southern Ohio, and Cincinnati, and the maximum quotations are dealers' prices f.o.b. at yards:

Per Gross Ton.

Bundled sheet scrap	$10.50 to $11.00
Old iron rails	14.25 to 14.75
Relaying rails, 50 lb. and up	21.25 to 21.75
Rerolling steel rails	13.25 to 13.75
Melting steel rails	11.25 to 11.75
Old car wheels	12.75 to 13.25

Per Net Ton.

No. 1 railroad wrought	$11.25 to $11.75
Cast borings	7.25 to 7.75
Steel turnings	7.75 to 8.25
No. 1 cast scrap	11.00 to 11.50
Burnt scrap	7.75 to 8.25
Old iron axles	18.25 to 18.75
Locomotive tires (smooth inside)	12.00 to 12.50
Pipes and flues	7.75 to 8.25
Malleable and steel scrap	9.25 to 9.75
Railroad tank and sheet scrap	6.75 to 7.25

Buffalo

BUFFALO, N. Y., December 30, 1912.

Pig Iron.—For a holiday week, when the market usually exhibits quietness, the total of purchases for this district has been notably heavy, aggregating between 50,000 and 55,000 tons of all grades, including some charcoal. Shipments on contracts have also been heavy, users continuing to anticipate their quotas in their specifications for delivery. The larger proportion of the tonnage booked was taken by one of the leading producers of the district which is quoting slightly under the maximum of the current schedule. The majority of the furnace interests are adhering to the maximum prices, however, and a good total of small orders is coming in at these prices, for prompt and first half deliveries, and furnacemen are of the opinion that a pronounced buying movement for the second half of 1913 will be in evidence shortly after the opening of the new year. We quote the following range of prices for first half delivery, f.o.b. Buffalo:

No. 1 foundry	$17.50 to $18.25
No. 2 X foundry	17.25 to 18.00
No. 2 plain	17.25 to 17.75
No. 3 foundry	17.00 to 17.50
Gray forge	16.50 to 17.25
Malleable	17.25 to 18.00
Basic	18.00 to 18.25
Charcoal, regular brand and analysis	18.25 to 19.25
Charcoal, special brand and analysis	22.00

Finished Iron and Steel.—Some of the producing interests are now taking orders for filling up on certain mills where they have a little unspecified tonnage to offer; this, however, is largely for sizes not in general demand and orders for large tonnage in standard sizes cannot find an opportunity for getting booked. Practically all new business now taken is from regular customers and for delivery at the mill's convenience which runs deliveries in July, August and September. Sheets are active. The demand for billets continues strong, coming largely from Canada, with pressure for first quarter and half delivery; but local producers are practically booked to capacity for that period. The Lackawanna Steel Company has received an order for 30,000 tons of open hearth steel rails from the Canadian Pacific Railroad. In fabricated structural lines the market is experiencing seasonable quiet, with few lettings of importance. The Lackawanna Bridge Company, which was low bidder for the 200 tons of steel for the J. P. Devine Company's plant, Buffalo, has been awarded the contract. Bids on the revised plans for the Masten Park high school, Buffalo, calling for 100 tons, are to be opened to-morrow. Plans are being prepared for two additional public school buildings in Buffalo which will take a considerable tonnage each and on which bids will be taken early in the new year.

Old Material.—The market is inactive, with minimum demand in nearly every commodity as many users will not receive material until after inventory. Dealers, however, anticipate a renewal of buying early in the new year, and prices are well maintained. The following schedule shows dealers' asking prices, per gross ton, f.o.b. Buffalo:

Heavy melting steel	$15.00 to $15.50
Low phosphorus steel	17.00 to 17.25
No. 1 railroad wrought	15.50 to 16.00
No. 1 railroad and machinery cast scrap	14.50 to 15.00
Old steel axles	16.50 to 17.00
Old iron axles	23.75 to 24.00
Old car wheels	16.00 to 16.75
Railroad malleable	14.00 to 14.50
Boiler plate sheared	15.00 to 15.50
Locomotive grate bars	11.50 to 12.00
Wrought pipe	10.25 to 10.75
Tank iron	10.50 to 10.75
Wrought iron and soft steel turnings	8.75 to 9.00
Clean cast borings	8.00 to 8.50

Birmingham

BIRMINGHAM, ALA., December 30, 1912.

Pig Iron.—The market has apparently recovered the buoyancy which was lagging for several weeks. As the year closes, the makers find themselves well sold into the first two months of 1913, and some sales covering the first half, with only about 70,000 tons on the yards and with the larger furnace operators holding with seeming firmness to the $14.50 level. Brokers affirm that $14 iron for early shipment can be procured in quantity, but none hears of anything under that, while sales involving small amounts are fetching $14.50 straight along. Some December sales by another concern were: Special analysis, spot delivery, at $15; No. 1 soft, first quarter, at $15; No. 1 soft, second quarter, at $15.50, and No. 2 soft, second quarter, at $15. A sale of a round lot of No. 2 soft for delivery to a regular customer for first half delivery was made by another maker. A sale of 1000 tons of charcoal iron was made at $25 and carload lots sold at $25.50. The charcoal iron capacity is now well sold into the first half, only two furnaces being in operation. The Sloss-Sheffield Steel & Iron Company has made shipments of 1000 and 1500 tons respectively to Genoa, Italy, and another shipment will move January 5. Nothing has been heard of further bookings of foreign orders, which depend on securing freight rates ahead of time by specific agreement. The Tennessee Coal, Iron & Railroad Company is preparing to blow in No. 1 Oxmoor furnace, having 50 tons daily capacity; its last idle furnace available will be ready for operation in 30 days. Furnace operators as a rule express thorough confidence in 1913 business, and one or two look for a $15 level as soon as January buying by the pipe makers begins in earnest. Sales of iron for second quarter delivery at $15 are reported, but specific data as to tonnage not given. Quotations for spot and through the first quarter as well as into the first half are as follows, f.o.b. cars, Birmingham:

No. 1 soft and foundry	$14.50 to $15.00
No. 2 soft and foundry	14.00 to 14.50
No. 3 foundry	13.75 to 14.25
No. 4 foundry	13.50 to 14.00
Gray forge	13.25 to 13.75
Basic	14.00 to 14.50
Charcoal	25.00 to 25.50

Cast Iron Pipe.—As far as orders are concerned, it has been a quiet week with the water pipe makers. There are a number of inquiries in hand and a good business is expected in January. Quotations remain the same, namely, $24.50 for 4 in. and $22.50 for 6 in.

and upward, with $1 added for gas pipe. Special castings cost $45 to $50 per net ton.

Coal and Coke.—There is no let-up in the strenuousness of the coal and coke situation. Foundry coke is selling at $3.75 to $4.25 per net ton at oven, with the available supply in demand and a comparative scarcity existing. Furnace coke has sold as high as $2.85. Coal movements are still hampered by a scarcity of cars and prices rule high.

Old Material.—The market has been quieter than for some weeks. A considerable supply of heavy melting steel has been ordered from one of the local dealers and relaying rails are moving in considerable quantities. Prices have changed but little and are as follows, per gross ton, f.o.b. dealers' yards:

Old iron axes	$15.50 to $16.50
Old steel axes	15.50 to 16.00
Old iron rails	15.50 to 16.00
No. 1 railroad wrought	13.00 to 13.50
No. 2 railroad wrought	11.50 to 12.00
No. 1 country wrought	9.50 to 10.00
No. 2 country wrought	9.00 to 9.50
No. 1 machinery cast	11.50 to 12.00
No. 1 heavy melting steel	11.50 to 12.00
Tram car wheels	12.00 to 12.50
Standard car wheels	12.50 to 13.00
Light cast and stove plate	9.50 to 10.00

British Market Strong

Semi-Finished Steel as High as £7—Tin Plate Mills May Close for Want of Orders

(*By Cable*)

MIDDLESBROUGH, ENGLAND, December 30, 1912.

Holiday dullness and Balkan politics are influencing sentiment somewhat. Coke is in short supply in the Cleveland district. Pig iron is firm, with an upward tendency. Stocks in warrant stores amount to 241,279 tons, against 239,941 tons one week ago. As high as £7 has been asked for English semi-finished steel for first quarter. Tin plate mills will probably close in the near future for want of orders for early shipment. We quote as follows:

Cleveland pig iron warrants (closing Monday), 67s. 8½d., against 67s. 1d. one week ago.

No. 3 Cleveland pig iron, maker's price, f.o.b. Middlesbrough, 68s. 3d., against 67s. 6d. one week ago.

Steel sheet bars (Welsh) delivered at works in Swansea Valley, £6, for January-March delivery.

German sheet bars, f.o.b. Antwerp, 112s. 6d.

German 2-in. billets, f.o.b. Antwerp, 107s.

German basic steel bars, f.o.b. Antwerp, £6 4s.

Steel bars, export, f.o.b. Clyde, £8 5s.

Steel joists, 15-in., export, f.o.b. Hull or Grimsby, £7 10s.

German joists, f.o.b. Antwerp, £5 12s. to £5 15s.

Steel ship plates, Scotch, delivered local yard, £8 7s. 6d.

Steel black sheets, No. 28, export, f.o.b. Liverpool, £9 15s.

Steel rails, export, f.o.b. works port, £6 15s.

Tin plates, cokes, 14 x 20, 112 sheets, 108 lb., f.o.b. Wales, 15s. 1½d.

New York

NEW YORK, December 31, 1912.

Pig Iron.—It has been a quiet week with local pig iron sellers, transactions reported amounting to but a few thousand tons. Few lots were over 300 tons, and the largest reported is 900 tons. Foundries are calling for shipments sharply up to schedule, and the indications are rather for an increase than a decrease in foundry output. Considerable buying is to be done for first quarter and first half and activity is looked for before January has very far advanced. We quote as follows for Northern iron at tidewater: No. 1 foundry, $18.75 to $19.00; No. 2 X, $18.25 to $18.75; No. 2 plain, $18 to $18.25. Southern iron is quoted at $18.75 to $19 for No. 1 foundry and $18.25 to $18.75 for No. 2.

Structural Material.—The cessation in awarding fabricated material contracts is regarded as an acceptable breathing spell by the mills, but generally the year opens with satisfactory promise, as there is a considerable amount of building work in this territory under consideration, not to mention the subway and elevated railroad work in New York, which will take definite form on the final closure of contracts, now apparently close to consummation. The filled-up condition of fabricators is indicated perhaps in the status of the American Bridge Company, which has 150,000 tons now on its books, although a portion of this will, of course, be spread over 1913. While the Carnegie Steel Company at the last information is still holding for 1.45c. Pittsburgh, for plain structural material for future delivery at its own convenience, material for such delivery is bought elsewhere for 1.50c. Pittsburgh, while for delivery in three months, 1.60c. Pitsburgh is commonly quoted. For emergency work, however, the prices are close to 2c. Among contract awards may be mentioned more of the New York Central area work, aggregating about 2360 tons, of which 1400 tons will be supplied by the McClintic-Marshall Construction Company and 260 tons by Lewis F. Shoemaker & Co. The latter company is also to erect a 360-ton pier-shed for the Philadelphia & Reading Railroad at Philadelphia. Plain material is quoted at 1.66c. to 1.76c. New York, mill shipments, the former for delivery in the third quarter and the latter figure for, say, three months. From store the price is 2.25c. New York.

Steel Plates.—The promise for 1913 for the mills seems good judging from the expectations of the car builders, as they have figured that the railroads are still in great need of rolling stock, notwithstanding the somewhat large contracts which have been placed in the last few months. There are no less than 64,600 cars already contracted for on which deliveries cannot begin before April 1, and while this represents business which has already passed through sales offices, it covers material which must yet be rolled and which is therefore calculated to keep deliveries somewhat extended for some time. Of pending business may be mentioned the 12,000 cars for the Harriman Lines; 1000 to 2500 steel cars for the Norfolk & Western; 1000 to 3000 coal and coke cars for the Chesapeake & Ohio; 2300 cars for the Illinois Central; 1800 for the Rock Island; 1900 or more for the United States Steel Corporation railroads; 4000 cars for the Missouri Pacific; 500 center constructions for Swift & Co.; several thousand for the New York Central, which is now inquiring for 1000; 1500 for the Wheeling & Lake Erie; 450 underframes for the Michigan Central; and 35 passenger equipment cars for the Delaware, Lackawanna & Western. The Santa Fé has purchased 900 furniture and 900 gondola cars in addition to the refrigerator cars mentioned last week, and the Pressed Steel Car Company closed with the Denver, Northwestern & Pacific for 300 gondolas. Local demand for plates is still dull and the quotations are 1.50c., Pittsburgh, or 1.66c., New York, for mill shipment in the third quarter, and 1.76c. New York for sheared plates and 1.81c. for universal plates delivered in four to eight weeks.

Iron and Steel Bars.—Urgent requirements for steel bars are still filled by supplying iron bars, and specifications for bar iron continue heavier than the production capacity. Some contracts for the first half of 1913 have been closed with the interesting fact that an advance usually of $2 a ton has been fixed for the second quarter. Quite a number of steel bar contracts have been placed with consumers for the entire year of 1913 at 1.40c., Pittsburgh, with stipulations, however, that monthly proportions must be taken or else there will be cancellations of the amounts not wanted at the time. Steel bars are quoted at 1.40c., Pittsburgh, or 1.56c., New York, mill shipment, for delivery at the convenience of makers, and from store, 2.05c. Refined iron bars are 1.70c. to 1.75c., New York, and from store, 2.05c.

Cast Iron Pipe.—Nothing of importance has transpired. Quotations are firm at $25 to $27, per net ton at tidewater, for carload lots of 6 in., according to the condition of makers' order books.

Old Material.—The market is exceedingly quiet. Consumers are deferring purchases until January. Dealers' quotations are nominally as follows, per gross ton, New York and vicinity:

Old girder and T rails for melting	$12.00 to $12.50
Heavy melting steel scrap	12.00 to 12.50
Relaying rails	22.50 to 23.00
Rerolling rails	14.00 to 14.50
Iron car axles	24.00 to 25.00
Old steel car axles	16.00 to 16.50
No. 1 railroad wrought	13.75 to 14.25
Wrought iron track scrap	13.00 to 13.50
No. 1 yard wrought, long	12.50 to 13.00
No. 1 yard wrought, short	12.00 to 12.50
Light iron	5.25 to 5.75
Cast borings	8.25 to 8.75
Wrought turnings	8.50 to 9.00
Wrought pipe	10.75 to 11.25
Old car wheels	15.50 to 16.00
No. 1 heavy cast, broken up	12.00 to 12.50
Stove plate	9.75 to 10.00
Locomotive grate bars	9.00 to 9.50
Malleable cast	11.50 to 12.00

The annual meeting of the Efficiency Society will be convened on Monday, January 27, at 9.30 a. m., in the Engineering Societies Building, 29 West Thirty-ninth street, New York.

St. Louis

ST. LOUIS, MO., December 30, 1912.

The closing week of the year found business generally quiet, as was to have been expected but deliveries on existing contracts showed every evidence of activity, especially in the matter of urgency as to shipments.

Pig Iron.—There was quite a business, considering the period, in small lots for immediate needs. The largest deal of the week, as far as ascertainable, was for about 800 tons of basic to come into St. Louis territory, but captured by Eastern makers. This was for immediate shipment and was quite actively competed for.

Coke.—The situation has grown worse instead of better and the prices quoted are practically on the basis of the urgency of the needs of the consumer.

Finished Iron and Steel.—In the finished product market there was a notable activity in the demand for shipment on contract. In standard steel rails there was no business. In light rails there was a reasonable demand considering the period of the year, while track fastenings continued above the normal in request. There was practically nothing doing in plates.

Old Material.—A further slackening of business is reported, except in relaying rails, for which the demand continues strong and the supply remains short. The mills, however, are taking practically nothing, owing to the inventory period, and are even refusing to consider attractive lots and prices. Quotations are largely nominal, as there has been no real market upon which to base figures. We quote dealers' prices, f.o.b. St. Louis, as follows:

Per Gross Ton.

Old iron rails	$15.00 to $15.25
Old steel rails, rerolling	14.25 to 14.75
Old steel rails, less than three feet	13.25 to 13.75
Relaying rails, standard section subject to inspection	23.50 to 24.50
Old car wheels	14.25 to 14.75
Heavy melting steel scrap	12.75 to 13.25
Frogs, switches and guards cut apart	13.00 to 13.50

Per Net Ton.

Iron fish plates	$12.25 to $12.75
Iron car axles	20.00 to 20.50
Steel car axles	16.00 to 16.50
No. 1 railroad wrought	11.75 to 12.25
No. 2 railroad wrought	11.25 to 11.75
Railway springs	11.25 to 11.75
Locomotive tires, smooth	12.75 to 13.00
No. 1 dealers' forge	9.25 to 9.75
Mixed borings	7.75 to 8.00
No. 1 busheling	10.75 to 11.00
No. 1 boilers cut to sheets and rings	7.75 to 8.00
No. 1 cast scrap	11.75 to 12.25
Stove plate and light cast scrap	8.75 to 9.00
Railroad malleable	11.25 to 11.75
Agricultural malleable	10.00 to 10.50
Pipes and flues	7.75 to 8.00
Railroad sheet and tank scrap	7.25 to 7.75
Railroad grate bars	9.25 to 9.75
Machine shop turnings	8.75 to 9.25
Bundled sheet scrap	7.50 to 8.00

Boston

BOSTON, MASS., December 30, 1912.

Old Material.—The dealers report that the better feeling which they expected to experience early in the New Year is already in evidence, as is evidenced by the advance of 25c. in borings and turnings. The quotations given below are prices offered by the large dealers to the producers and to the small dealers and collectors, per gross ton, carload lots, f.o.b. Boston and other New England points which take Boston rates from eastern Pennsylvania points. In comparison with Philadelphia prices the differential for freight of $2.30 a ton is included. Mill prices are approximately 50c. a ton more than dealers' prices:

Heavy melting steel	$11.75 to $12.00
Low phosphorus steel	14.00 to 15.00
Old steel axles	15.00 to 15.50
Old iron axles	23.00 to 23.50
Mixed shafting	14.00 to 14.25
No. 1 wrought and soft steel	11.75 to 12.00
Skeleton (bundled)	10.00 to 10.25
Wrought iron pipe	10.50 to 10.75
Cotton ties (bundled)	10.00 to 10.25
No. 2 light	4.50 to 5.00
Wrought turnings	8.25 to 8.50
Cast borings	8.00 to 8.25
Machinery, cast	13.50 to 14.00
Malleable	11.00 to 11.50
Stove plate	9.00 to 9.50
Grate bars	8.00 to 8.25
Cast-iron car wheels	13.50 to 14.00

Metal Market

NEW YORK, December 31, 1912.

The Week's Prices

Cents Per Pound for Early Delivery.

	Copper, New York.			Lead		Spelter	
Dec.	Lake.	Electrolytic.	Tin, New York.	New York.	St. Louis.	New York.	St. Louis.
26	17.75	17.50	50.30	4.30	4.15	7.30	7.15
27	17.75	17.50	50.45	4.30	4.15	7.30	7.15
28	17.75	17.55	50.50	4.30	4.15	7.30	7.15
30	17.75	17.62½	50.65	4.30	4.15	7.30	7.15
31	17.75	17.62½	50.65	4.30	4.15	7.30	7.15

Copper strengthened after big buying and is firm at the 17.75c. basis. Tin is rather quiet, but prices are higher. Lead has a better tone, though expected heavy buying has not yet come. Spelter is firmer at unchanged prices. Antimony continues unsettled.

New York

Copper.—In the closing week of the year the United States Steel Corporation came into the market strong and bought 7,000,000 lb. of electrolytic copper at prices ranging from 17.62½c. to 17.75c., cash 30 days, delivered. Smaller lots which helped to make the total, were picked up at the lower price, but it is reported that large quantities which the producers alone could supply brought the full price of 17.75c., and practically all was for delivery in January and February. Demand had slackened off until the Steel Corporation became active, when there also developed demand from other sources, but of much smaller proportions. Resale copper on Thursday and Friday of last week sold down to 17.50c., 30 days, delivered, for prompt and January delivery, but not much of this cheaper copper was available and the producers and big agencies demanded full prices. Some brands of Lake have sold at 18c., in limited quantities. For Lake generally there has been a quiet but steady demand for January and February delivery. The price of the metal to-day is 17.62½c., 30 days, delivered, for electrolytic, and 17.75c. cash New York for Lake. The price in London is £76 12s. 6d. for spot and £77 11s. 3d. for futures. The exports this month total 27,228 tons. The feeling is that the purchases of the Steel Corporation will inaugurate greater activity, as smaller consumers will be encouraged to buy.

Pig Tin.—This metal has been very quiet, except on Saturday when about 200 tons of futures were traded in, but mostly between dealers. The last few days has seen a temporary scarcity of spot tin, the end of which is in sight, following the arrival of the Minneapolis with 935 tons. Prices have stiffened considerably, and to-day 50.65c. is asked. The price in London to-day is £229 10s. for both spot and futures. December arrivals totaled 3601 tons and there is afloat 1216. Deliveries into consumption in December totaled 4050 tons, having exceeded all estimates. Stocks at the end of the month are 1290 tons.

Tin Plates.—The market is strong at unchanged prices, the basis being $3.60, Pittsburgh. Demand is general from the tin plate consuming industries, notably the canners and tinware manufacturers, and from 10 to 14 weeks is required for deliveries on new contracts.

Lead.—The market is a little firmer, but continues dull, the recent good inquiries not having materialized, although they have served to make the situation stronger. The New York price is 4.30c., and that in St. Louis 4.15c.

Spelter.—While there has been a tendency toward firmness and the metal has been quoted throughout the past week at 7.35c., New York, the price for actual business is nearer 7.30c., New York. The market has been very dull and uncertainty as to tariff changes is having an influence on new buying.

Antimony.—There has been no change from the unsettled condition incidental to the desire to unload speculative lots, and prices are for this reason uncertain. For Cookson's quotations are 9.87½c. to 10.25c.; for Hallett's, 9.50c. to 9.75c., and 8.75c. to 9c. for Chinese and Hungarian grades.

Old Metals.—Inquiries continue to increase. Dealers' selling prices are firmer and in some instances higher, as follows:

	Cents per lb.
Copper, heavy and crucible	17.00 to 17.25
Copper, heavy and wire	16.00 to 16.25
Copper, light and bottoms	14.50 to 14.75
Brass, heavy	10.25 to 10.50
Brass, light	8.50 to 8.75
Heavy machine composition	14.00 to 14.25
Clean brass turnings	9.50 to 9.75
Composition turnings	12.00 to 12.50
Lead, heavy	4.25
Lead, tea	4.00
Zinc, scrap	6.00

St. Louis

DECEMBER 30.—The metal market has been rather [illegible] during the week. Lead, after a slump, closed [illegible] at 4.17½c.; spelter ended quietly at 7.15c. Tin [illegible] in a narrow range, finishing at 50.25c. to 50.55c.; [illegible] copper closed unchanged at 17.97½c. to 18.22½c.; electrolytic, 17.87½c. to 18.12½c.; Cookson's antimony, [illegible]c. On miscellaneous scrap metals we quote as follows: Light brass, 6.50c.; heavy brass and light copper, [illegible]c.; heavy copper and copper wire, 13c.; pewter, [illegible]; tinfoil, 36c.; zinc, 4c.; lead, 3.50c.; tea lead, 3c.

Iron and Industrial Stocks

NEW YORK, December 31, 1912.

For the greater part of the period which has elapsed since our last report the stock market was fairly firm, though quiet, but on Saturday some recession occurred under the leadership of United States Steel, which suffered a decline when announcement was made that freight rates on its ore carrying roads were to be investigated by the Interstate Commerce Commission. On Monday a striking development was the heavy decline in Steam Pump stocks. In many stocks no sales occurred during the week. The range of prices on active iron and industrial stocks from Thursday of last week to Monday of this week was as follows:

Am. Can, com.....	28½- 30⅞	Int. Pump, pref....	63 - 70
Am. Can, pref.....	114 -116	Lackawanna Steel ..	47½- 48
Am. Car & Fdy., com.	54¼- 55½	Nat. Enam. & St., pref....	90
Am. Car & Fdy., pref.....	117	Railway Spring, com.....	34
Am. Loco., com.....	41¾- 42⅝	Republic, com.....	26
Am. Loco., pref.....	106⅛	Republic, pref.....	86¼
Bald. Loco, com....	51 - 51⅞	Rumely Co., pref.....	99½
Bald. Loco., pref.....	104	U. S. Steel, com...	66⅛- 68½
Beth. Steel, com....	38 - 39¼	U. S. Steel, pref...	109 -109⅝
Beth. Steel, pref....	68 - 68½	Westinghouse Elec..	78½- 81
Deere & Co., pref...	99⅜- 99⅞	Am. Ship, com.....	53
Emer-Bram, pref...	99½-100	Chic. Pneu. Tool...	53 - 53⅛
General Electric....	183 -188⅛	Cambria Steel.....	49¾- 50¼
Gr. N. Ore Cert....	40¼- 40⅝	Warwick	10½
Int. Harv., com....	111 -112	Crucible Steel, com..	16½- 16⅞
Int. Harv., pref....	114½-115	Crucible Steel, pref.	93 - 93¼
Int. Pump, com....	12 - 19⅛		

Dividends Declared

The General Fireproofing Company, Youngstown, Ohio, regular quarterly, 1¾ per cent., payable January 1.

The National Fire Proofing Company, Pittsburgh, regular quarterly, 1 per cent., payable January 15.

The Chicago Pneumatic Tool Company, regular quarterly, 1 per cent., payable January 25.

The Vulcan Detinning Company, regular quarterly, 1¾ per cent. on the preferred stock, payable January 20.

Metal Market Features of 1912

In 1912 there were many odd, unusual or otherwise interesting features disclosed in the metal market, some of which are here enumerated:

Copper

In copper the year reached its climax in August, the production of that month being 145,628,521 lb. or 65,013 gross tons, which broke all records. Great as the production was, and with stocks on hand at the beginning of the month of 50,280,421 lb., the stocks at the end of the month were diminished 3,579,047 lb.

The largest decrease in stocks in any one month was 23,174,052 lb. in January. Stocks at the beginning of that month were 89,454,695 lb., the smallest in three years.

Imports of copper in 1912, Government statistics of which are not yet available, are expected to prove record breaking. Exports will not much exceed, if they equal, those of 1911.

Between the opening and closing of 1912 the total advance in price for electrolytic was about 3c., or 14.25 to 17.27c. and higher.

In March copper touched 15c. for the first time in five years.

Retardation of production in June, because of strike troubles at the Baltimore, Md., and Perth Amboy, N. J., refineries of the American Smelting & Refining Company, was offset by similar troubles at the plants of the Standard Underground Cable Company at Perth Amboy and the National Cable & Conduit Company, Hastings, N. Y., both large consumers.

In November exports were the smallest of any month in two years.

Pig Tin

Tin closed the year about 6c. higher than in January when the price was 44.25c. In December the New York price went not only to 50.25c., but at times was quoted a little higher.

In February a new standard form of tin contract was adopted by the New York Metal Exchange in the endeavor to broaden trading on the floor of that institution, but the bulk of transactions are still outside of the exchange.

An unusual feature of April was that Banca tin for prompt shipment was selling higher than Straits tin and Banca usually is a secondary choice at lower prices.

During the time of the big shipping strike in London many shipments were made from Holland instead of London to avoid delay.

In the six bi-monthly auction sales of Banca tin in Holland in 1913, 1200 tons less will be sold than in 1912.

Lead

Lead is the only metal which did not close the year with substantially higher prices than prevailed in January. The latter part of the year not only witnessed keen competition but was further depressed by light demand and fear of tariff reduction on the metal and ore.

A new factor in lead which appeared in 1912 was the International Smelting & Refining Company.

At one time in September lead was so high in London that it could be bought at 4.85c., New York, and profitably resold in London. The price was advanced to 5.10c., New York, for this reason.

Antimony

An unusual feature of antimony in January and February was that Hallett's sold higher than Cookson's, because of a reported scarcity of the former. Ordinarily the higher price is for Cookson's.

Antimony was the last metal to respond strongly to the general advancing of prices and much of it was bought for speculative purposes. Re-appearance of this metal below the import price unsettled the market in the latter part of the year.

Spelter

The activity of the brass mills and galvanizers created a great demand for spelter. The price of 7.25c. to 7.30c., New York, in December was regarded as high in view of the quieting of demand which came in that month. Large quantities of spelter were imported subject to drawback duties.

Aluminum

In the year aluminum advanced from around 19c. until it was quoted at 26.50c. to 27.50c. per lb. Following the formation of a combination abroad early in the year, prices advanced in Europe and later started their upward course here. The foreign movement resulted in a contraction of the number of American sellers of imported metal. At times American producers could not fully supply the demand and some consumers were obliged to use other metals or buy foreign aluminum at high prices.

Parcel Post Expectations

WASHINGTON, D. C., December 31.—The parcel post system goes into effect to-morrow, and Postmaster General Hitchcock has instructed postmasters throughout the country to report to the department as early as possible the volume of business presented. There is the keenest interest as to how the system is going to work out, and it is possible that in a week or ten days the department will make public a summary of the amount of business handled and the revenue derived therefrom.

The institution of the parcel post system may have an important bearing on the proposed revision of the tariff. Democratic members of the House and Senate who were identified with the passage of the law creating the system predict that the revenue to be derived from it will be so large that it will allow heavy cuts to be made in the tariff schedule, the revenue from the parcel post to take the place of custom receipts to a large extent. W. L. C.

The Princess Iron Company's furnace at Glen Wilton, Va., will be blown in this week, following extensive repairs.

Ore Freight Rates in Minnesota

Investigation by Commerce Commission

The Interstate Commerce Commission has decided to make a formal investigation of the freight rates on iron ore from the Mesaba range in Minnesota, and has named as defendants in the proceedings the Great Northern Railway Company, Duluth, Missabe & Northern Railway Company and Duluth & Iron Range Railroad Company, the latter two alleged to be owned or controlled by the United States Steel Corporation. Complaint has been made to the commission that independent ore producers and consumers are discriminated against by virtue of the present rates; also, that the rates are made intentionally high, the Great Northern Railway being a party to the agreement, and that the United States Steel Corporation ships only over its own lines and that when it pays its freight bill "it virtually amounts to transferring money from one pocket to another." This is the order of the commission:

It appearing that the rates, practices, rules and regulations governing the transportation of iron ore have been the subject of formal and informal complaints to the commission:

It is ordered that an inquiry be and the same hereby is instituted by the commission on its own motion into the rates, practices, rules and regulations of the Great Northern Railway Company, Duluth, Missabe & Northern Railway Company and Duluth & Iron Range Railroad Company, governing the transportation of iron ore from producing fields in the State of Minnesota to the docks at Duluth, Minn., and Superior, Wis., when destined to points beyond the docks and without the State of Minnesota and when such transportation forms a part of the carriage of such ore to a point or points without the State of Minnesota.

It is further ordered that this proceeding and inquiry be conducted with a view to the issuance of an order or orders requiring such respondents to cease and desist from charging, demanding, collecting, or receiving rates and charges for, and from enforcing their practices, rules and regulations governing the transportation of iron ore from points of origin to destinations herein referred to, in so far as the same may be found to be unlawful and requiring such respondents to substitute and thereafter to put into force and effect such rates, rules, practices and regulations relative to the transportation of iron ore as aforesaid as may be found just and reasonable, and not unjustly discriminatory.

It is further ordered that the commission shall set this proceeding for hearing at such times and places as may be hereinafter determined.

It is further ordered that a copy of this order and of subsequent orders and notices in this proceeding be served upon the various common carriers, respondents herein.

Mesta Engines Inspected

The Mesta Machine Company invited members of the Engineers' Society of western Pennsylvania and others to visit its works at West Homestead, Pa., December 28, to make an inspection of a twin tandem compound reversing engine and a direct flow steam engine, both of which were on the erecting floor. The company provided a special train from Pittsburgh for the visitors.

The twin tandem compound reversing engine is being built for the Youngstown Sheet & Tube Company, Youngstown, Ohio, and is said to be the most powerful rolling mill engine ever constructed. It has two high pressure cylinders, 46 x 60 in., and two low pressure cylinders, 76 x 60 in. The maximum speed of the engine is 200 r.p.m. The principal objects in view when designing this engine were simplicity, economy and strength. The valve gear is less complicated, drives more directly and has fewer parts than the standard simple twin reversing engine. The throttle and reverse gear are controlled by a single lever. By this arrangement the steam consumption is reduced and the engine can be reversed more quickly than by the old method. The engine is symmetrical on each side of the center line. The main shaft is in two pieces, which are duplicates of each other, and all moving parts on one side of the engine are duplicates of the other.

The direct flow steam engine is being built for the power plant of the Carnegie Institute of Technology. It has a single cylinder 28 in. in diameter, 42 in. stroke. The Mesta Company designed this type of engine to take the place of compound engines and steam turbines where economy equal to compound engines and steam turbines is required and where simplicity is essential. The steam consumption of this type of engine is said to be equal to that of compound engines of the standard type, and for non-condensing operations less than that of steam turbines of equal capacity. The claims made for the Mesta direct flow engine are that it combines simplicity, economy of operation and low cost of installation.

The Year's Development in Large Valves

In the valve industry the past year has evidenced the ever-increasing tendency of the times to supplant manual by machine labor and non-automatic control by automatic. The Pittsburgh Valve, Foundry & Construction Company reports that in 1912 it has put into service about 200 motor-operated valves, mostly gate valves ranging in size from 10 in. to 54 in. The valves included a large number for the United States Navy Department for recently completed dry docks on both the Atlantic and Pacific coasts; steam valves, both cast-iron, bronze mounted for exhaust steam, and cast-steel monel-mounted for live steam, and air valves for blower and blast lines.

The control system used at present consists of a limit switch, circuit breaker and line switch. When the valve gates reach the end of their travel in either direction the circuit breaker is short-circuited through the limit switch and goes out. The majority of the valves mentioned were equipped with a limit switch especially designed by the company to show instant and accurate adjustment, a valuable feature considering that when a valve has been in service for some time it "drifts" more after shutting off the current than does a new valve. Among butterfly valves of large size electric motors play an important part in operating mechanisms. The company is at present building two 96-in. valves of this type.

An interesting feature of motor-operated valves is the possibility of remote control. Where the control station is as distant as two or three miles from the valve the company has designed a relay system of remote control requiring only two light wires.

Carbon Steel Company Changes

Owing to the large increase in the business of this company, it has been decided to divide the duties hitherto performed by S. M. Wetmore, general superintendent. Mr. Wetmore has been appointed manager of sales, and is succeeded as general superintendent by C. E. Middleton, formerly assistant superintendent of the Shoenberger plant of the American Steel & Wire Company. D. R. Wilson, formerly in the Eastern sales department of the company, has been elected treasurer. The other officers of the company now are: Charles McKnight, president; Gilbert G. Thorne and George S. Macrum, vice-presidents; D. R. Wilson, treasurer; D. E. Corbett, secretary. The company is making extensive improvements in its plant which are well under way. It manufactures high grades of open-hearth steel, and for some time has been successfully making alloy steels, including the more important nickel and chrome-nickel grades, and when the improvements are completed the output in all lines will be very largely increased.

The Mannesmann Tube Works Increases Capital

At the stockholders' meeting of the Mannesmann Röhrenwerke, Düsseldorf, Germany, held recently for the purpose of raising the capital to 61,000,000 marks by adding 16,000,000 marks, the general director made an interesting statement as to the policy and purposes of the company. He denied that it was aiming to monopolize the tube business; the arrangements recently made with several other producers of the tubes were only for the sale of their product, they being left completely independent in all other respects. He said that the chief advantage of the arrangements is that they render it possible to have the individual concerns specialize and thus produce only the products for which they are best adapted. The capital increase is for acquiring the Königin Elisabeth coal mine at a price of 15,000,000 marks. The company now consumes 400,000 tons of coal yearly, and it expects to obtain 300,000 tons of this from the purchased mine, thus saving 700,000 marks a year on its coal bills. It was intimated that the company would later build blast furnaces to make its own supply of pig iron unless it should succeed in placing long-term contracts for iron at favorable prices.

Personal

The directors of the Youngstown Sheet & Tube Company, Youngstown, Ohio, have accepted with regret the resignation of George E. Day, for over 10 years general manager of sales of the company. He intends to retire from business permanently and will spend the winter in Florida. He is succeeded by W. E. Manning, who for some years has been assistant general manager of sales. The successor to Mr. Manning has not yet been appointed.

S. S. Eagle, from the general offices of the American Car & Foundry Company, has been appointed manager of the company's plant at Terre Haute, Ind., succeeding I. G. Reading.

The Singer Sewing Machine Company has appointed Walter J. Rickey, of its South Bend, Ind., plant, to manage the largest sewing machine factory in the world, at Glasgow, Scotland, the company's main plant.

Ivy L. Lee, formerly in charge of the publicity bureau of the Pennsylvania Railroad at Philadelphia, has been made executive assistant to the president.

Robert E. Brooke of the E. & G. Brooke Iron Company, Birdsboro, Pa., has been elected president of the Eastern Pig Iron Association for 1913. William S. Pilling was re-elected secretary.

D. R. Swinton, who has been identified with the Chicago office of the Nordberg Mfg. Company, has joined the Tuthill Spring Company, 760 Polk street, Chicago.

W. H. Foster, president General Fireproofing Company, Youngstown, Ohio, has returned from a European trip. He states that in all the countries visited, with the exception of Austria-Hungary, the people appeared prosperous and contented.

F. G. Kretchmer, president of F. G. Kretchmer & Co., machinery importers, with offices in Frankfort-on-the-Main, Vienna and Budapest, was guest of honor at a box party given by Rufus King, president King Machine Tool Company at the Grand Theatre, Cincinnati, Ohio, on the evening of December 18. Others present were E. A. Muller, general manager King Machine Tool Company; J. W. Carrel, general manager Lodge & Shipley Machine Tool Company; A. H. Teuchter, president Cincinnati Bickford Machine Tool Company; Edmund Miller, capitalist, and A. E. Robinson, general superintendent American Tool Works Company.

J. B. Doan, vice-president and general manager American Tool Works Company, Cincinnati, Ohio, spent several days last week in Washington, conferring with the Senate Committee on the machine tool tariff question.

C. Stuart Somervell, formerly manager of the Lycoming Foundry & Machine Company, Williamsport, Pa., has been appointed general manager of the Herreshoff Motor Company, Detroit, Mich.

Obituary

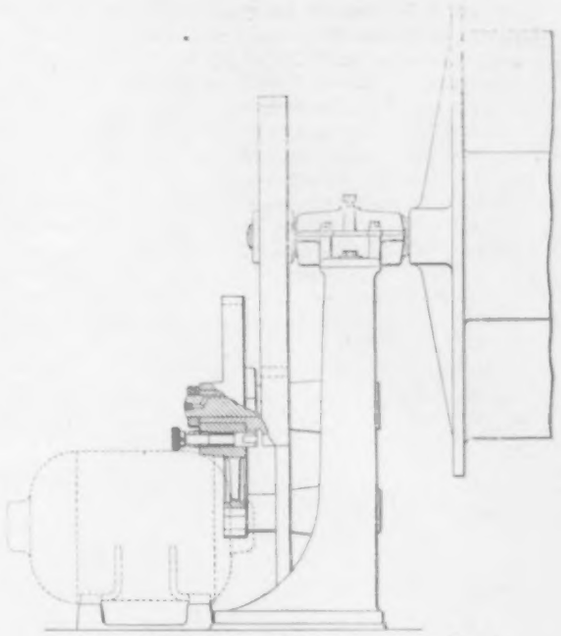
GEORGE N. SMITH, Boston, Mass., president Boston Woven Hose & Rubber Company, died December 20, aged 72 years. Formerly a shoe manufacturer, Mr. Smith was one of the pioneers in the formation of the enterprise which later took form as the General Electric Company. On the reorganization of the Boston Woven Hose & Rubber Company, in 1899, he was elected a director and the president, which offices he held until his death. He leaves a widow and three children.

HARRY B. HARE, assistant secretary and assistant treasurer of the Otis Steel Company, Cleveland, Ohio, was killed December 28 in an automobile accident. Driving his car home late at night, he ran into a deep sewer excavation. He died a few minutes after reaching a hospital. He was 42 years of age and had been connected with the company 12 years, having been first associated with the sales department. He was a member of the University, Euclid, Union and Athletic clubs and the Chamber of Commerce, Cleveland.

The Oliver Iron & Steel Company, Pittsburgh, Pa., is sending out cards to its friends commemorating the semi-centennial organization of this company, which has closed its fiftieth year. It is one of the oldest manufacturing establishments in the Pittsburgh district.

Motor Driven Burnishing Barrel

The Abbott Ball Company, Hartford, Conn., has brought out a burnishing barrel equipped with direct drive from an electric motor of the company's standard type.



Clutch for Controlling Drive of Burnishing Barrel

The barrel can be brought to rest by the operator at any time by disengaging the clutch shown in the line drawing, located in the smaller gear of the drive. This mechanism is of simple design, the engagement being positive.

Caswell & Starke Incorporated

The metal brokerage business conducted for many years at 99 John street, New York, by E. A. Caswell has been incorporated under the name of Caswell & Starke, Inc. E. W. Starke has been associated with Mr. Caswell for the past 17 years, and will be the active manager of the new corporation. In the announcement made by Mr. Caswell of the change he states that the business will be continued on strict brokerage lines as heretofore, specializing in tin, copper and lead.

A new steel castings plant will be established in Cleveland, Ohio, by the Standard Castings Company, which has been incorporated with a capital stock of $100,000. The company has purchased and will remodel the plant formerly occupied by the Superior Drop Forge & Mfg. Company at West Seventy-third street and the Big Four Railroad. One cupola and one converter will be installed. The company will confine its activities almost entirely to the manufacture of small steel castings and expects to be operating by about April 1. Julius F. Janes, former treasurer of the Morgan Lithograph Company, Cleveland, will be president; C. S. Cutler, Cleveland manager of the B. S. Sturtevant Company, treasurer; R. M. Calfee, secretary, and John H. Davis, general manager. Mr. Davis was connected with the Otis Steel Company for over 20 years, having been superintendent of its steel foundry for the past 7 years. Other Cleveland men interested are E. H. Janes, E. W. Moore, B. C. Tucker and J. F. Devereux.

The Akron, Ohio, plant of the Wellman-Seaver-Morgan Company, Cleveland, was partly burned December 29. The most serious damage was done to the pattern storage department. One end of the foundry building was burned. In the same city a large section of the plant of the International Harvester Company was burned December 28.

The McCutcheon works of the Carnegie Steel Company on the North Side, Pittsburgh, was damaged by fire last week to the extent of $40,000, but it was not sufficiently serious to interfere with the operation of the plant.

New Iron and Steel Works Construction

(Continued from page 105)

Crucible Steel Company of America

Important new construction of this company under way in 1912 was concentrated largely at Midland, Pa., for the Pittsburgh Crucible Steel Company, an identified interest. This new work includes the building of eight 75-ton open hearth furnaces with provision for two more, a 45-in. blooming and billet mill of the Mackintosh Hemphill type, the engine to drive this mill being furnished by the same company. There will be four five-hole soaking pit furnaces with a capacity of eight ingots to a hole; calcining house, skull cracker building, brick shed and Scaife water purifying plant. There are 240 coke ovens at Midland, of which 165 will be in operation early in the year, and these ovens will furnish sufficient coke for the present blast furnace. The company built 118 houses of various types last year to be occupied as homes by the employes of the Midland works, and this number will be increased in 1913 to about 1000 houses. Early in November a contract was placed with the Morgan Construction Company, Worcester, Mass., for a continuous merchant bar mill to be erected at Midland, the roughing stand to be 14 in. and the finishing stands 12 in. to 8 in. These mills will roll from 3/8 to 2 in. rounds and all sizes of squares and merchant flats. The company has also placed a contract for the building of a 24-in. reversing bar mill to be driven by a William Tod Company engine, the product of this mill to be from 2-in. to 8-in. rounds. The company has always been a large manufacturer of railroad springs, and on this new mill it will roll steel car axles. The structural steel in all of the buildings now under way and contemplated at Midland amounts to about 21,000 tons. About half the new construction under way at Midland is completed and the remainder will be finished in the late summer this year.

At its Park works in Pittsburgh, the company built 10 B. & W. Stirling water tube boilers of 500 h.p. each, to replace 54 old style tubular boilers, which have been dismantled and the material sent to Midland, later to be cut up and used in the open hearth plant there. A new annealing plant was also added to the Park works for high speed steels, and a new dock was built on the Allegheny River to receive coal for the plant. It is the intention in 1913 to replace all wooden structures at the Park works with steel buildings of modern fireproof construction.

At its Crescent works in Pittsburgh the company installed six B. & W. Rust water tube boilers of 400 h.p. each and is replacing a wooden building with a steel structure to contain these boilers.

At Syracuse, N. Y., the company will build a new tool steel plant to be operated under the name of the Syracuse Crucible Steel Company. It will be run in connection with the Sanderson plant of the company in that city, but will have twice the capacity of the Sanderson works. All the mills in this new plant will be motor-driven and will work automatically. It is intended to make this the most modern tool steel plant in the country. The fabrication for the steel buildings, about 4000 tons, was placed with the McClintic-Marshall Construction Company of Pittsburgh.

At its Atha works at Harrison, N. J., the company increased the capacity of the gun shop 25 per cent. to take care of Government work and added a 50-ton Campbell type tilting basic open hearth furnace and a Heroult 5-ton electric furnace to make electric steel. At the Atha works it erected new buildings for treating steel, a new press building with hydraulic press of 1500 tons capacity, equipped with steam intensifier, together with necessary equipment of furnaces, cranes, etc. It also built a new dock on the Passaic River opposite the Atha works, equipped with DeLaval pumps to furnish water to the entire plant, the water line being of 50-in. reinforced concrete pipe. It built at the Atha works a new office building, a new inspection building and a new storehouse. All these structures are of steel and are fireproof. Westinghouse low-pressure turbo-generators were installed to use exhaust steam in producing current for the electric furnace.

The Crucible Steel Company of America also owns the Crucible Coal Company, which has opened up a large mine in Greene County, Pa., to supply coal to the Midland, Pa., works. It has placed a contract with the American Bridge Company for 22 steel barges to haul coal from the mine to this plant. Two are to be finished in January and the other 20 in May, June, July and August next, five each month. The barges will each have a capacity for carrying 500 tons of coal, and they will be so constructed that after delivering coal to the Midland works they can carry billets on the return trip for delivery to the steel mills of the company in the Pittsburgh district. At present 50 wooden barges are run in this service, with a steamboat for towing purposes. A contract has been placed in Parkersburg, W. Va., for another steamboat to be known as Midland No. 1.

No improvements were made in 1912 at the Singer works in Pittsburgh, but at the La Belle works on the North Side, Pittsburgh, a new runway was built to handle billets.

Cambria Steel Company

The most important new construction by the Cambria Steel Company last year was the building of three 75-ton furnaces at the Franklin open-hearth steel works at Johnstown, together with cranes, charging machines and other equipment. There was installed a new cinder and skull breaker. In the wire department 32 nail machines were added, a new machine shop was built and equipment provided for heavy reels for reeling chain rods and heavy rods. In the car shop department there were the completion of a shop for composite steel and wood cars, the installation of an electric welder for car parts and the provision of electric transfer cars for inter-shop handling of car parts. For additional electrical power a 6000-kw. turbo-generator was installed, together with additional steam plant, condensers and other equipment. Two electric traveling cranes were added for stock house work. In the company's coal mining operations an electric haulage system was added.

Republic Iron & Steel Company

This company has under way the construction of 8-in., 12-in., 16-in. and 20-in. bar mills in its Brown-Bonnell works at Youngstown, Ohio, and expects to have these works completed by April 1, 1913. Two additional open-hearth furnaces and one soaking pit furnace are being added to the open-hearth steel department, which will likely be completed about August, 1913. Four new fire-brick, hot-blast stoves are being added to No. 1 furnace at Haselton, Ohio, which will be completed early in 1913. The company has also under contract a by-product coke oven plant at Haselton, but the field construction has not been started on this work, and the ovens will not be completed until very late in 1913. The company has no new construction under way at its Alabama plants.

Halcomb Steel Company

The extensions to the plant of the Halcomb Steel Company at Syracuse, N. Y., which were under way in 1912, are all complete or nearing completion, representing a total investment of about $100,000. Among them are the following: A Morgan producer and coal hoppers at the open-hearth furnaces; steel and brick addition to the wire-annealing building, 80 x 130 ft.; steel and brick wire-drawing addition, 40 x 240 ft.; new building, 30 x 50 ft., for storage of fuel and quenching and lubricating oils at paint shop; steel addition to heat treatment department, 40 x 60 ft., with installation of seven oil furnaces and quenching tanks for handling product from small tools up to 14-ft. bars; two-story 25 x 50-ft. addition to machine shop; addition to rolling mill, 18 x 100 ft., also a building 20 x 50 ft. for chipping and inspection of billets.

Inland Steel Company

The No. 2 blast furnace of the company was completed at Indiana Harbor, with an annual capacity of 150,000 tons. A spike, track bolt and rivet department was completed and put in operation, with an annual capacity of 30,000 tons. A new department started in the year is that for the manufacture of steel barrels. Contracts on which work is still in progress cover four additional 60-ton open-hearth furnaces, a 9-in. sheared plate mill and 65 by-product coke ovens. In view of the necessity of giving up oil as fuel in the open-hearth department the company contracted for 36 Hughes mechanically poked gas producers, together with coal and ash handling storage bins and trestles. This new construction also involves the addition of a number of regenerative chambers and the remodeling of eight furnace ports.

Pittsburgh Steel Company

In February, 1912, the Pittsburgh Steel Company, operating an open-hearth steel plant, rod, wire and wire nail mills at Monessen, Pa., and steel hoop and band mills at Glassport, Pa., placed a contract with the Garrett-Cromwell Engineering Company, Cleveland, for the building of two 500-ton blast furnaces at Monessen, each to be 90 ft. by 22 ft. 6 in. Each furnace will be equipped with four McClure three-pass, firebrick stoves, 22 x 100 ft. The blowing engines are of the cross-compound type and there are four 15,000,000-gal. pumping engines. The boiler plant consists of 8500 hp. Active work on these furnaces was started last spring, and it is expected one stack will be ready about May 1, and the other about July 1, 1913.

Jones & Laughlin Steel Company

This company completed early in 1912 the second unit of 12 hot tin plate mills at Aliquippa, Pa., making 24 in all. Its No. 4 blast furnace at Aliquippa which was completed late in 1911 was not put in operation until the fall of 1912. In October work was started on 600 rectangular or Belgian type coke ovens, which will have an output of about 1800 tons of coke per day. The company contemplates the building of a pipe mill at Aliquippa, and probably plate and structural mills, but definite plans for these have not been made.

Youngstown Sheet & Tube Company

None of the new construction at the works of the Youngstown Sheet & Tube Company, Youngstown, Ohio, announced one year ago, was completed in 1912, but the company expects to have finished by April, 1913, a new open-hearth plant consisting of six 75-ton furnaces; also a new blooming mill. It is completing a fourth blast furnace which will have a capacity of 500 tons a day. The company made considerable outlays last year on various improvements, including the increase of its shipping facilities in order to permit the shipping of its maximum tonnage.

John A. Roebling's Sons Company

At the Trenton, N. J., works of the John A. Roebling's Sons Company, flat shop No. 1, destroyed by fire in December, 1911, was rebuilt last year. At the company's Roebling, N. J., plant an extension to the open-hearth department consisting of three 40-ton furnaces is under construction. A four-story steel and brick building, 76 x 270 ft., was added to the wire cloth department at Roebling.

Brier Hill Steel Company

This company is building at Youngstown, Ohio, seven 75-ton open-hearth furnaces which are expected to be completed in September or October. About 20 per cent. of the structural work is finished and all equipment has been purchased. The plant is so built that seven additional furnaces can be added later.

The Gogebic Steel Company

Plans for new construction on 450 acres of land purchased by the Ferdinand Schlesinger interests at Hammond, Ind., have not yet developed sufficiently to fix a time for the beginning of work. It is expected, however, that some work will be done in 1913. The Gogebic Steel Company, an Indiana corporation, with a capital of $500,000, has been organized to hold the land and to carry on construction and manufacturing operations.

Eastern Steel Company

At its Warwick furnaces, Pottstown, Pa., the company added to its pumping equipment one turbine driven centrifugal pump with a capacity of 7,500,000 gal. in 24 hours. The new 400-ton thin lined blast furnace, known as A, was completed and blown in. It is 85 ft. high, with bosh and hearth diameters of 20 and 14 ft. respectively. The company is now adding to the equipment for this furnace one new 20 x 80-ft. Roberts 3-pass central combustion chamber stove which is about completed, and is also installing a Dwight & Lloyd sintering machine to be used on flue dust and fine ores.

Upson Nut Company

The Upson Nut Company started a number of improvements to its steel plant at Cleveland. These include an extension to its finishing mill building and the enlargement of its billet and scrap yards. This company in the coming year may add a new furnace to its open-hearth plant. In 1912 the Upson Nut Company commenced the entire rebuilding of its bolt and nut department. As a first step in these plans it started the erection late in the year of a forge shop 176 x 630 ft., and a six-story concrete building to be used for pattern storage and office purposes, this building providing 7500 sq. ft. of floor space on each story.

Corrigan, McKinney & Co.

Corrigan, McKinney & Co., Cleveland, secured a site last year and awarded a contract for the buildings for a large steel plant, the erection of which is expected to be started about February 1. This plant will include an open-hearth department with eight 65-ton furnaces, 40-in. blooming mill, rail mill and probably another finishing department. However, no definite decision as to the finished output has yet been reached further than that there will be a rail mill. It is expected that the plant will be ready for operation about the middle of 1914.

Otis Steel Company

The Otis Steel Company, Cleveland, recently purchased a 200-acre site in the upper Cuyahoga River Valley, on which it will erect a steel plant consisting of open-hearth furnaces and light and heavy plate mills. Eventually the company also intends to erect blast furnaces.

La Belle Iron Works

Improvements now under way by the La Belle Iron Works, Steubenville, Ohio, consist of one 50-ton open-hearth furnace, making 11 in all; 1000-hp. addition to the boiler plant; feed-water heating and treating plant; three turbine-driven centrifugal feed pumps; scrap bundling machine and plant, and various cranes and crane runways. The total cost of these improvements will be about $225,000.

Lukens Iron & Steel Company

The Lukens Iron & Steel Company, Coatesville, Pa., put up last year a large steel building to replace several wooden buildings, covering the shearing and cooling floors of its 84-in. and 112-in. mills. The company has also erected a building to cover a large rotary shear and other appliances at its 140-in. mill. Its output of steel is now greater than ever.

Carbon Steel Company

The Carbon Steel Company, Pittsburgh, has recently completed the installation of a 500-ton steam hydraulic forge press. A 70 x 300-ft. overhead crane runway, with crane and magnet for handling raw material, is under construction and will soon be completed. The company is adding a 500-hp. Rust boiler in the boiler house and a Newton horizontal milling machine is being added in the machine shop. It will probably install a universal mill with overhead crane runway. Several open-hearth furnaces will be rebuilt and the facilities for handling material in the shipping department increased.

Maryland Steel Company

The new construction now in progress at Sparrows Point, Md., is the rebuilding of the Maryland Steel Company's B blast furnace, making it a duplicate of A furnace, which was rebuilt about one year ago.

Deforest Sheet & Tin Plate Company

The Deforest Sheet & Tin Plate Company, Niles, Ohio, bought considerable ground adjacent to its plant last year and contemplates the building of an open-hearth plant, though the time for starting work has not been determined. The company has been adding five cold-roll mills, three hot-sheet mills and one jobbing mill, the last named to roll 10 to 16-gauge sheets. These give a total of nine hot mills, one jobbing mill and five cold mills. A low pressure steam turbine electric generator unit of 1000-kw. capacity is being added, together with condenser pump, etc. Other additions include a continuous pair furnace and a continuous sheet annealing furnace; an extension to the main rolling mill building, 200 ft. long, and a new galvanizing department consisting of six galvanizing pots, pickling house, etc., in a building 80 x 300 ft.; new blanking and stamping department for special steel shapes, and a hydraulic compress for bundling steel scrap.

S. DIESCHER & SONS.
Mechanical and Civil Engineers.
PITTSBURGH, PA.

Atlanta Steel Company

Appropriations of $300,000 were made at the annual meeting of this company in January to be spent on additions and improvements, including a 50-ton open-hearth furnace and a Morgan continuous billet mill to roll small billets. Additional woven wire machinery were also provided for and improvements in the wire and rod mills.

Columbia Steel Company

The Columbia Steel Company, which has plants at Portland, Ore., and Pittsburg, Cal., installed a 42-in. cupola, a 5000-lb. converter, a Rockwell furnace, blowers, etc., together with a 7½-ton electric traveling crane. This apparatus is to be used exclusively for the manufacture of manganese steel at the Portland works. For housing it an addition has been built to the present shop which will give a floor space 40 x 120 ft. for this department, including molding floor. The company has also built a 40 x 60-ft. addition to its main foundry building to increase its molding floor and has installed a 10-ton high-speed electric traveling crane. The manganese department is housed in a side bay of the main foundry. A new annealing oven 14 x 20 x 10 ft. high will accommodate large work.

West Penn Steel Company

Improvements and extensions made by the West Penn Steel Company at Brackenridge, Pa., to its open-hearth steel plant and sheet mills last year give the company a total annual capacity of 50,000 tons of sheets. Last year the company added three stands of hot rolls, three stands of cold rolls, two resquaring shears, two roller levelers, one open leveler and one pickling machine.

Portsmouth Steel Company

The principal work now under way at the Portsmouth, Ohio, plant of this company is the building of a 60-ton open-hearth furnace. In February, 1912, it started a new sheet mill, which added two jobbing and five sheet mills to its equipment.

Bethlehem Steel Company

The construction programme outlined for the year 1913 promises to be one of the most active in the history of the Bethlehem Steel Company, $6,000,000 having been appropriated by the board of directors to cover numerous improvements and additions to the company's plants. The improvements will include one new 22 x 90-ft. blast furnace complete; six additional 75-ton open-hearth furnaces for the Saucon plant; six additional 50-ton open-hearth furnaces for the Lehigh plant; an electric melting furnace department; new rolling mills for the crucible steel department, together with a complete new blooming mill and merchant mill department for the rolling of special and alloy steels. Improvements of a miscellaneous character will be made to a number of the present departments.

ENLARGED BLAST FURNACE CAPACITY, LEHIGH PLANT

Work has been started on a new 500-ton blast furnace, which will be known as blast furnace A. The furnace will be in every respect a duplicate of the four large modern furnaces known as D, E, F and G, now in operation. It will be equipped with five 22 ft. x 100 ft. McClure stoves and an electrically operated skip hoist. With the completion of this furnace the blast furnace plant will consist of five large modern furnaces and two smaller furnaces, the combined plant having an output capacity of 1,000,000 tons of pig iron per year. The furnace will be blown by two 42 x 60-in. Bethlehem gas-driven blowing engines, and with their completion there will be a total of eleven Bethlehem gas-driven blowing engines in operation in connection with the blast furnace plant. For the blast furnace boilers, a complete new feed-water heater and pump installation will be finished within the next month.

The enlarged furnace plant has made necessary an additional ore bridge crane for handling the raw materials and this is to be purchased at once. It will be a duplicate of the present one, with a span of 247 ft. from center to center of towers, and a total over-all length of 550 ft. The capacity of the grab bucket will be 14 tons.

It has also been found necessary to purchase additional limestone properties adjacent to the company's present quarries at McAfee, N. J. Plans are being perfected for equipping the limestone-quarries with modern machinery for quarrying and crushing the limestone.

LARGE CAPACITY ALLOY STEEL MILLS, LEHIGH PLANT

The company also recently purchased the property on which the plant of the New Jersey Zinc Company was formerly located, comprising 12 acres immediately adjoining the western end of the Bethlehem works, and on this and adjacent property the following will be located:

A new open-hearth furnace plant of six 50-ton furnaces, to work in conjunction with the present Lehigh plant open-hearth furnaces in supplying steel for the new merchant mill department referred to later. These furnaces, in the main, will be run for the making of special alloy steels. The plant will be complete within itself and specially designed for making the higher grades of alloy steels. The melting capacity for the higher grades of crucible and alloy steels will be further supplemented by an electric furnace plant. The work on the first one of these furnaces has now begun, and the first furnace should be in operation by the middle of 1913.

The new mill department will comprise a two-high reversing 32-in. blooming mill, electrically driven; a continuous mill; a four-stand 22-in. mill; a 16-in. and 12-in. combination mill; a 12-in. and 8-in. combination mill, and a 10-in. guide mill. All the mills will be new, except the 12-in. and 8-in. mills, which will be moved from their present location, and in their place is to be erected, with new buildings, 12-in., 10-in. and 8-in. hand mills, and a complete finishing department, with annealing furnaces, straighteners, etc., to provide for the proper finishing of the output of the crucible and electric furnace departments. A special feature of this new mill layout will be the application of electricity to all drives, including the blooming mill, 22-in mill, the smaller mills and shears; in fact the entire supply of power is planned to be electrical.

The blooming mill will be served with specially constructed soaking pits for the careful and uniform heating of the high grade steels, which in turn will be served with the usual stripper and charging and drawing electric cranes. A new finishing department, including cold-drawing and straightening machines, as well as tempering and annealing facilities, will be provided for the proper handling of the output from the various mills.

OTHER NOTABLE CHANGES IN LEHIGH PLANT

To provide electric power for these new extensions, it is planned to install four additional 3000-kw. generators, driven by Bethlehem gas engines, supplementing the present gas-driven electric-power installation. The new electric generators will be of high-voltage alternating current, and will be tied into the present direct-current generators with a large-motor generator balancing set, for the purpose of distributing the load factor over both the alternating and direct-current generators.

Adjacent to the new crucible finishing building is the old puddle mill department, which will be rebuilt during the year, and placed in new brick and steel buildings, which is to be the standard of construction throughout the new mill extensions.

The present two-story carpenter and pattern shop, with a floor area of 34,000 sq. ft., will be vacated, and this building will be used to provide additional machine shop capacity for the manufacture of army field guns, limbers, caissons, carriages, etc. This will necessitate the construction of a new building to be used as a carpenter and pattern shop, which will be four stories in hight, of brick and steel construction, with general dimensions of 80 x 180 ft. Adjacent to this will be erected a two-story mechanical and electrical repair shop and storehouse, to serve the requirements of the entire Lehigh plant.

The cleaning and finishing end of the steel foundry will be entirely rebuilt of permanent construction, with further additions to the building. For additional pattern storage for the steel foundry, a new fireproof 5-story 60 x 200-ft. building will be erected. Similar improvements are to be made to the iron foundry.

A number of new machine tools are either purchased, or approved for purchase, for addition to the different machine shops, consisting of all classes of machines, planers, roughing lathes, cold saws, boring mills, etc. One of the principal installations in this line is the entire replacement of the old machines with modern ones, in the roughing end of the large No. 2 machine shop. This equipment is for the particular purpose of increasing the facilities for increased machined forging output.

To the projectile department is being added additional heating facilities and a number of machine tools, to increase generally the capacity for all sizes of projectiles.

In the drop forge department, an entire new finishing plant is being installed, consisting of warehouse, heat-treatment, cold-trimming and shipping sections. It is planned to provide warehouse facilities for the carrying on stock of a number of standard lines of forgings, to insure prompt shipment. A well equipped yard and storage for bar stock, to serve this department, is about completed. This storage is commanded by electric overhead cranes, and the stock carried in racks protected from the weather. In the hammer section it is planned to add ten new drop hammers, ranging from 800 lb. to 2500 lb. in capacity.

A new locomotive repair shop and roundhouse is to be erected, providing storage and repair facilities for the transportation department. A number of new locomotives and locomotive cranes are to be purchased to meet the additional transportation requirements.

An addition to the general office building of the company, which is located at Third and Poplar streets, South Bethlehem, Pa., is practically completed. The extension will be four stories high, the same as the original office building, as well as increasing the east wing from one to four stories in hight. A fifth floor will also be added to this building in the ensuing year, to provide restaurant facilities for the officers and heads of the various departments, and United States and foreign government representatives stationed at the works.

In addition to the enlarged facilities of the general office building, a handsome brick building is being erected at the east end of the Lehigh plant for the United States army and navy officers permanently stationed at the works. This building will include a chemical laboratory for the use of the United States Government chemists. The company's present chemical and physical laboratories, which are now in separate buildings, have proved inefficient to meet the constantly increasing requirements of the plant, and to provide for this condition, a combined chemical, physical and metallographic laboratory building will be constructed. The building will be two stories in hight, of ample size to cover the present as well as the future needs of the company. The laboratories will be fitted up in the most modern and complete manner, requiring in itself a great deal of new equipment.

There is now in course of erection an extension of 60 x 300 ft. to the armor plate department machine shop, to provide additional erecting and assembling space, as well as room for additional machinery, consisting of a heavy pit planer and grinding machines. The new extension will be provided with a 75-ton electric traveling crane. During the coming year the steam engines driving the various machines in this shop will be dismantled and replaced with electric motors, which will complete the entire changing of all the company's machine shops over to electric drive. In the treatment section of the armor plate department there has been added in 1912 an additional 50-ft. carbonizing furnace and a 100-ton electric traveling crane. A new office building, 40 x 70 ft., has been provided for the department, combining the heads of the various sections of this department in one central location.

In the merchant forge department there has been added in the year two new heating furnaces, one for the 4000-ton hydraulic forging press, and the other for one of the large hammers. There is now being erected a new office building to be used as combined office for both the merchant forge and open-hearth No. 1 departments.

To be completed the ensuing year, a new system of air compressors is being installed, replacing all the old steam-driven compressors scattered throughout the plant. The compressors are of two types, electric-motor driven, with 2500 cu. ft. capacity per minute, and two low-pressure steam-turbine-driven rotary compressors, to deliver, respectively, 2500 and 5000 cu. ft. of air per minute. These last two compressors will be driven by the exhaust steam from the hammers in the hammer forge, and the exhaust steam from the pressure pumps in the armor plate department. With this installation complete, the entire air compressor system throughout the plant will be either motor driven or driven by exhaust steam.

A 1000-TON MIXER AT THE SAUCON PLANT

Six 75-ton open-hearth furnaces are being added to the Saucon open-hearth plant, making in all, when completed, a total of 16 furnaces, with an ingot capacity of 1,000,000 tons per year. This enlarged plant will be so arranged that it can be operated either by the straight open-hearth process or by the duplex process in connection with the two 20-ton Bessemer converters already in operation. The addition to the open-hearth building is 160 ft. wide and 800 ft. long. To the equipment for serving the new furnaces will be added a 60-ton charging floor crane, a 75-ton mixer crane and an additional electric charging machine. To supplement the present mixer capacity, consisting of two 400-ton mixers and one 250-ton mixer, a new 1000-ton mixer will be installed. This mixer will be of special design, electrically operated, and when in operation will be the largest in use in any steel plant in the United States.

An additional electric power unit, consisting of one 1500-kw. generator, driven by a Bethlehem gas engine, is being added to the electric power station at the Saucon plant. This engine is to be operated on by-product coke-even gas which the company is receiving from the Lehigh Coke Company's plant, which was placed in operation in 1912, located immediately adjacent to the steel company's works, and erected primarily for the purpose of supplying coke to the steel company.

The various extensions and additions to the plants have made necessary the providing of increased water supply, and for this purpose there is being added to the central pumping station two 18,000,000-gal. pumps.

Additional finishing capacity to the already large beam yard has been installed, consisting of an additional crane runway and a specially designed motor-driven shear with tables, built by the Bethlehem Steel Company, for shearing beams and channels from stock.

CINDER RECLAIMING PLANT TO BE BUILT

It has been decided to erect a central cinder and scrap reclaiming plant, through which all the cinder from the various blast-furnace, open-hearth and Bessemer plants will be passed, for the reclaiming of the iron and steel.

Plans are being prepared for the erection of a warehouse in Boston, Mass., to carry on stock for the New England territory a supply of the company's products, such as the various kinds of tool steels, staybolt iron, special steel shapes and bars.

In order at all times to insure an absolutely pure drinking water supply to the employees of the company, a mechanical filtering plant, approved by the Pennsylvania State Board of Health, has just been put into service, and is now supplying drinking water throughout all the departments of the Lehigh and Saucon plants.

Apollo Steel Company

The new plant which is being established by the Apollo Steel Company at Apollo, Pa., for the manufacture of high grade black and galvanized sheets, will consist of a building 157 x 500 ft., to contain six hot sheet mills, three cold mills, four annealing furnaces and two galvanizing pots. No power plant is necessary, as the mills will be motor driven from current to be supplied by a local traction company. The engineering work is by the United Engineering & Foundry Company, Pittsburgh.

Ashland Steel Company

The Ashland Steel Company, Ashland, Ky., has made important improvements to its plant in the year. An electric stripper and five electric cranes, built by the Morgan Engineering Company, Alliance, Ohio, have been installed to replace hydraulic machinery. In addition the company is loading by electric crane its products consisting of steel billets and the by-products thereof, such as roll scale and slag. In the rod mill department a 32 x 56 x 48-in. reciprocating engine, built by the C. & G. Cooper Company, Mount Vernon, Ohio, has been erected and a large simple engine has been converted into a 42 x 72 x 60-in. compound. These engines are for driving the rod mill roll trains. Both are served by a Heander condenser of ample capacity. In this department also are three new centrifugal pumps furnished by the De Laval Steam Turbine Company, Trenton, N. J., and a complete electrical installation, five air-lift wells and a Norwalk compressor have been added. The plant has been given a general overhauling and has been modernized in every detail.

Other Steel-Making Additions

The Penn Steel Castings & Machine Company, Chester, Pa., replaced its Tropenas converters with an oil-fired

5-ton acid open-hearth furnace in 1912, permitting of a considerably increased output. The company also installed a new 36 x 10 x 7-ft. oil-heated annealer.

A Heroult electric furnace was built at the Sharon, Pa., plant of the National Malleable Castings Company.

The Eagan-Rogers Steel & Iron Company completed a foundry at Crum Lynne, Pa., in which was installed a Stoughton 2-ton side blow converter. Later an electric furnace will be added to further refine the steel under what is known as the electro-Bessemer converter process.

The Keystone Steel Casting Company, Chester, Pa., added a 4-ton open-hearth furnace.

The Treadwell Engineering Company, Easton, Pa., early in the year completed the installation of a 2-ton electric furnace for steel castings.

The Union Steel Casting Company, Pittsburgh, added a 25-ton acid open-hearth furnace at its No. 2 plant in the past year.

United States Steel Corporation

The new construction undertaken by the United States Steel Corporation's subsidiaries in 1912 was largely additions to its open hearth steel capacity. The call for open hearth steel rather than Bessemer steel becoming more pronounced as the year advanced. Very little new construction had been undertaken by the Steel Corporation in 1911, and by the close of that year most of the extension work planned and begun in the two or three preceding years had been finished. A conspicuous exception was the Minnesota Steel Company project near Duluth. The following statement indicates the present status of work on new plants of various subsidiaries and the progress made in the past year.

Indiana Steel Company

Of the eight blocks of Koppers by-product coke ovens at Gary, 70 ovens each, three blocks unfinished at the end of 1911 were completed and started in the early months of 1912. An important rolling mill at Gary begun last year was a 36-in. slabbing mill which will provide slabs for the 60-in. universal plate mill at Gary, as well as for the two jobbing plate mills of the American Sheet & Tin Plate Company, which roll plates less than ¼ in. thick. This mill will probably be completed in the spring of 1913. It will be driven by a compound condensing engine. The main engine, which is 44 and 76 x 60 in., is twin-tandem compound-geared reversing. The engine for the vertical rolls is a three-cylinder, compound direct-connected engine 36 and 44 and 44 x 48 in. The No. 2 power house at Gary was completed early in 1912, when six 3000-kw. units were installed, consisting of electric generators and gas engines using blast furnace gas. In recent months contracts have been let for four more similar units. All the ten units are furnished by the Allis-Chalmers Company. Two of the open hearth groups at Gary, 14 furnaces each, will be equipped with waste heat boilers, to furnish steam for the slabbing mill engines referred to above, and for blowing the gas producers.

Illinois Steel Company

Work has begun at the No. 1 open hearth plant at South Chicago on an extensive programme of construction. Two 50-ton furnaces will be added and four of the present 35-ton furnaces will be rebuilt and remodeled to give them a capacity of 45 tons each. A new power plant at Joliet has been completed in the past year and its three gas-electric units of 3000 kw. each are in operation.

Carnegie Steel Company

At the Edgar Thomson works the construction of fourteen new 60-ton open hearth furnaces has been under way for some months. Rail mill construction is also in progress at Edgar Thomson. Heretofore the No. 2 mill has rolled rails of intermediate section above 45 lb., while No. 1 mill has rolled heavy rails and the No. 3 mill light rails. A new mill is being built to replace No. 2 mill, but it will roll the heavier sections, while the present No. 1 mill will hereafter be devoted to intermediate weights.

The new rail will also be equipped to roll sheet bars and small billets. The principal work undertaken in the past year at the Duquesne plant was the construction of a fast 10-in. merchant bar mill.

At the Clairton plant of the Carnegie Steel Company work was started about three months ago on two additional 60-ton open hearth furnaces.

American Steel and Wire Company

The new rod and wire mills in the Birmingham, Ala., district, located at Corey, about one mile distant from the Ensley works, were brought near to completion in 1911, and some of the equipment was made ready for installation early in 1912, but the plant has not yet been started up.

A 3000-kw. gas engine generator was installed at the Central furnaces of the company at Cleveland last year to supply power for the Newburgh and Cuyahoga works.

Tennessee Coal, Iron & Railroad Company

The 280 Koppers by-product coke ovens were completed and put in operation in the early months of 1912.

American Sheet & Tin Plate Company

An appropriation was made in July, 1912, for additional open hearth capacity at the Apollo Works of the company at Vandergrift, Pa., and two furnaces of 60 tons capacity are now under construction.

Minnesota Steel Company

Contracts were placed in March, 1912, for two 500-ton blast furnaces for the new plant near Duluth, Minn. The shell work and stoves of these furnaces are now about completed. Most of the various buildings which have been heretofore enumerated have been erected. In August a contract was placed with the Bethlehem Steel Company for five gas blowing engines, 45 and 81 x 60 in. For the general power house four gas-electric engines of 3000 kw. each are under contract. Rolling mill contracts placed in the past year were for a 40-in. blooming mill, a 28-in. rail or finishing mill, a 28-in. roughing mill, and a 16-in. continuous mill. Coke for the blast furnaces will be furnished by 90 Koppers by-product ovens, which are now under construction. The seven 75-ton open hearth furnaces under construction by this company will have an annual capacity of about 300,000 tons.

Blast Furnaces

The Shenango Furnace Company, operating three blast furnaces at Sharpsville, Pa., renewed the furnace shell and lining of its No. 3 furnace last year, and is now installing a high-speed blowing engine at its Nos. 1 and 3 furnaces.

The Andrews & Hitchcock Iron Company completed the relining of its No. 1 blast furnace at Hubbard, Ohio, last month. It was blown in on December 11, with the expectation also of continuing the operation of the No. 2 furnace as well.

The Keystone furnace of the Reading Iron Company, Reading, Pa., is being remodeled, a skip hoist and accessories being added. The work is expected to be finished by the spring of 1913.

The Wellston Steel & Iron Company, Wellston, Ohio, is rebuilding its No. 3 or Milton furnace, putting up a new furnace stack and hoist house, and expects to have new stove equipment early in the spring of 1913.

While substantially all the construction work on the C and D furnaces of the Iroquois Iron Company, South Chicago, was done before the beginning of the year, they were not actually completed until 1912. The furnaces are 21 x 85 ft., with 14-ft. hearth diameter. They are equipped with three turbo blowers.

The Northwestern Iron Company has had under construction a battery of 36 coke ovens of the Otto Hoffman type, at its furnaces at Mayville, Wis., and they will probably be in operation by the middle of April.

The two new Susquehanna furnaces of the Rogers-Brown Iron Company, at Buffalo, on which practically all the construction work was done many months ago, were completed in 1912. One was blown in on February 5 and the other on August 1. Their capacity is rated at 120,000 tons a year each.

The Wilson-Snyder Centrifugal Pump Company, Pittsburgh, recently made shipments of three 20,000,000-gal. pumps to the Youngstown Sheet & Tube Company, Youngstown, Ohio, to supply the open-hearth department; a 15,000,000-gal. pump to the Allegheny County Light Company, Pittsburgh, and a 10,000,000-gal. pump to the Mexican Petroleum Company, Tampico, Mexico.

Rolling Mill Work

Additions by the United Steel Company, Canton, Ohio, in 1912 included the installation of 12 new gas producers, doubling the size of the producer plant, a 40 x 200-ft. extension to its blooming mill building, a blooming mill engine, bloom shear and other equipment, and the erection of a steel storehouse.

The Reeves Mfg. Company, Canal Dover, Ohio, completed and put in operation in 1912 six new sheet mills, three galvanizing kettles and a complete new roofing department 100 x 750 ft. All buildings are steel and concrete construction.

At the tube works department of the Reading Iron Company, Reading, Pa., a pair of coal-fired furnaces (one bending furnace and one lap-weld furnace) have been replaced with gas-fired furnaces.

The Trumbull Steel Company, Warren, Ohio, has had under construction a sheet and tin plate plant with a main building about 80 x 1000 ft. and a tin house 70 x 500 ft. There are six hot sheet mills and six tin mills.

The Massillon Rolling Mill Company, Massillon, Ohio, manufacturer of sheets, added two hot mills last year and increased its cold rolling department from five to 11 mills. The annual capacity is now 40,000 tons.

New work done by the Page Woven Wire Fence Company at its Monessen, Pa., plant last year consisted of the installation of further equipment, which increased the capacity to 75,000 tons a year.

The Wheeling Sheet & Tin Plate Company was formed at Wheeling, W. Va., headed by Isaac M. Scott, to build a 10-mill tin plate plant.

New Construction in Canada

Dominion Iron & Steel Company, Limited

In 1912 very considerable additions were made to the producing capacity of the Dominion Iron & Steel Company, Limited, at Sydney, Nova Scotia, the greater part of what was under construction at the beginning of the year having been completed and put in operation. The increase in the output of coke due to the addition of 120 improved Otto ovens enabled the company to keep in full operation the four blast furnaces originally built and to blow in a new furnace immediately on its completion on September 14. Since that date the five stacks have been continuously in operation. This has permitted an increase in the output of steel and has furnished a moderate tonnage of pig iron for sale. In August operations were begun in the wire and nail department and the output has been steadily increased and on January 1, 1913, it had reached the maximum for which it was designed.

NEW WORK COMPLETED AND PUT IN OPERATION IN 1912

Wire and nail plant. Output, wire nails (1000 kegs a day), galvanized wire and barbed wire fencing.

Cooperage with drying kilns and storage, 40 x 160 ft.

Rod bundle carrier, 700 ft. long, to transfer bundles from rod mills to wire mill.

Sulphuric acid plant; total with sulphur storage, 14,000 sq. ft.

Pattern storage building, 60 x 100 ft.

Rearrangement of rail finishing mill in new building, 100 x 400 ft.

Mill trunk sewer, concrete and brick, 1500 ft. long.

No. 8 blast furnace, four stoves, stock bins, etc. Plant and equipment are as follows: Eight 500-hp. B. & W. gas fired boilers with superheaters and building. Two mixed pressure turbo blowers, capacity of each 32,000 cu. ft. of air per min., at 10 to 18-lb. pressure; also surface condensers. Intake and pump house in harbor, 30 x 100 ft., containing two turbine pumps of 8,000,000 gal. per day, at 40-ft. head, and two turbine pumps of 18,000,000 gal. per day, at 175-ft. head—all direct-connected to a.c. induction motors. One 36-in. cast iron pipe line for lower pressure, 1200 ft. long to condensers, and one 48-in. pipe line for higher pressure, 1000 ft. long, to blast furnaces. A 100-ft. extension to iron ore pier to accommodate new ore boat of 11,000 tons' carrying capacity. A 350-ft. extension to stock yard. A No. 5 Brownhoist ore bridge, 225-ft. span, and 320-ft. trolley travel. A granulating slag pit, 20 x 80 ft., with locomotive loading crane. A ladle repair building, 68 x 180 ft., with 40-ton four-motor ladle crane, grinding pan, storage bins and ladle drying stands.

General office building, 65 x 135 ft., four stories.

A 40-ft. extension to chemical and physical laboratory.

NEW WORK UNDER CONSTRUCTION

No. 7 blast furnace with stoves and stock bins.

Two 500-ton open-hearth furnaces with gas producers, hydraulic pump house and boilers. It was expected that gas would be turned on one of these on January 1, 1913.

Four additional lime kilns.

Additional coke oven gas supply and purifying equipment.

Extension of 200 ft. to old rail finishing building.

A 100 x 700-ft. building for bar and rod mill, which will be ready for operation in February.

Addition of 3000-hp. B. & W. boilers with coal and ash-handling system. An 8,000,000-gal. cooling pond with return pumping system, practically finished. Extension to wire mill for pot annealing department. Electric substation, 40 x 60 ft., at coke ovens. Warehouse, 80 x 300 ft., at Montreal, Que., finished. Forty new houses for employees. Limestone loading pier with crushers, screens and conveyors, at Port-au-Port, Newfoundland.

Algoma Steel Corporation, Limited

New construction completed in 1912 by the above company consisted of the following:

A 35-in. blooming mill with tables, manipulator and engine.

A 28-in. rail mill with engine.

Addition of 1000 hp. of Babcock & Wilcox boilers.

Fifteen flat cars, 25 Hart-Otis general service cars, and two 60-ton locomotives.

One 1750-hp. turbo generator set.

New foundry, pattern, forge and machine shops.

One sulphuric acid plant, capacity 20 tons per day.

One additional pit furnace.

One 2000-hp. gas engine and generator.

Canadian Steel Foundries, Limited

The company's new steel foundry at Longue Pointe, Que., started in operation in July and has been producing successfully ever since. Only one open-hearth furnace has been working to date, but the second 25-ton furnace is completed and will be placed in operation shortly.

In the past year the company has made considerable changes and additions to its rolling mill at Welland, Ont., and has extended the building 100 ft., besides putting in new hotbeds for the 22-in. and 12-in. mills, two new five-door billet heating furnaces for the 12-in. mill. It has also made an addition to the mill in the shape of an 18-in. muck bar mill, with busheling and piling furnaces. This work is all completed and the mill is in full operation. The company is now adding 150 ft. to its foundry at Welland and installing a second 25-ton furnace. This work will be completed within the next two months.

Canada Steel Company, Limited

The plant of this company at Hamilton, Ont., consists of a rerolling mill for rolling rails down to merchant stock, such as angles, flats, squares, etc. This mill is driven entirely by electricity. The company in the past year added a new shipping building to its mill which is about 100 ft. long by 50 ft. wide. It now has under construction a new 8-in. mill for rolling small sections and expects to have it in operation early this year. The raw material for this plant will consist chiefly of billets.

Nova Scotia Steel & Coal Company, Limited

The company installed last year at its open-hearth works at Sydney Mines, Nova Scotia, a plant for fluid compressing steel under the Harmet patents. It consists of a group press capable of treating ingots of 3 to 5 tons. The first heat was treated according to this process on July 1. At the New Glasgow works installation was completed of a modern steam hydraulic forging plant, which with the use of fluid compressed steel, permits of turning out a high class of forgings.

Atikokan Iron Company

Reference was made in *The Iron Age* of December 5 to the plan this company has for replacing its small blast furnace at Port Arthur, Ont., with a large one, the intention being to make the latter the basis of a steel plant and rolling mill at Port Arthur. These plans have not been definitely worked out, however. The Atikokan furnace has been idle for many months.

The Machinery Markets

Reports for the week on machinery trade conditions as might be expected are unanimous as to the usual end of the year dullness, but practically everywhere there is equal unanimity as to the excellence of prospects for early 1913. Instead of reiterating assertions that trade is inactive features which are most noticeable will be mentioned. New York has a list good for at least $25,000 from the New York Central Railroad. Builders of cranes in Cleveland have enough orders to keep them busy for several months. Prospects are reported good in the Central South, while in Birmingham a substantial business was done despite the holidays and inquiries are encouraging for 1913. Demands for cotton working machinery and electrical equipment are becoming strong in Texas. On the Pacific coast December achieved a fair total of business and the outlook is favorable for continued activity.

New York

Review of 1912

NEW YORK, January 1, 1913.

In 1912 the machinery trade in all its branches participated to a very satisfying degree in the general business prosperity and substantial increases of output to meet the demand are recorded by manufacturers everywhere. In some of the larger distributing centers, New York and Detroit, for instance, and the same is true of others, some selling agencies doubled and even trebled their sales as compared with the previous year. In the last half of the year manufacturers were obliged to put deliveries forward time and time again, and in not a few cases sales were lost because of the inability to deliver as promptly as was desired, a condition which eased up as the end of the year approached, though it found many builders, especially of machine tools, still busy with the orders in hand which had been booked weeks if not months before.

Railroads Active in Buying Machinery

True to the predictions of *The Iron Age* a year ago, the railroads have been better and even heavy purchasers of shop equipment in the last year, with the Southern roads responding first in a very satisfactory way, the Middle Western ones following even more generously and some of the Eastern roads coming heavily into the market. The year opened with the large list of equipment before the trade required by the Delaware & Hudson for its Watervliet shops and it closes with large lists issued by the Boston & Maine and the National Transcontinental Railroad of Canada in hand. The year as a matter of fact has been rather remarkable for the number of large lists, aggregating millions in expenditure, which have appeared. Some of these and by no means all are as follows:

Delaware & Hudson.
Jersey City Technical High School.
Norfolk & Western.
Busch-Sulzer Bros. Diesel Engine Company.
Atchison, Topeka & Santa Fe.
National Car Company, Ltd.
New York, New Haven & Hartford.
Morgan's Louisiana & Texas Lines.
General Electric Company.
Boston & Maine.
National Transcontinental Railway.

Industrial Demand Good

Emphasis should be laid also on the good steady demand from industrial sources which has characterized a large portion of the year. This demand, while it usually means smaller indiivdual transactions, is a more certain indication of healthy condition than are the large lists. The latter are in reality of less importance than the general and more inconspicuous run of business, but they are stimulating in that they exhibit the confidence felt by the holders of large capital. One of the very largest contributors to the prosperity of the machinery trade has been the automobile industry, although there have been in that direction one or two unfortunate occurrences, such as the temporary embarrassment of the United States Motor Company. The automobile industry shows no abatement in its forward strides, and many of the manufacturers have been so taxed to supply the domestic demand that they have been unable to touch the enormous foreign field which awaits them. This is especially true of the higher priced cars, as many of the cheaper vehicles have invaded even remote corners of the earth and found great favor.

On the Pacific coast the machinery trade atmosphere was to a considerable extent cleared by the final absorption of several hundred thousand dollars' worth of second-hand machinery, which was in the market, and a detriment to the sale of new equipment.

Texas in the course of the year, though deprived for many months of Mexico as a trade outlet because of that country's political troubles, enjoyed a development that stands out against that of nearly every other State.

In the city of New York the prosecution of great public works, such as new subways and the tunnel to conduct the water to be supplied by the Ashokan system under the city, erecting the Grand Central Lines terminal, the building of the New York, Westchester & Boston Railway and other large undertakings, created a need for much contractors' equipment, and there is prospect soon of a new source of such demand when the building of 1000 ft. piers is undertaken by the city of New York.

Usually Disturbing Factors Ignored

A notable feature of the year is that the machinery trade, like most others, was affected to an almost negligible degree by the Presidential election, despite the fact that it involved the candidacy of a man committed to tariff revision and whose party had not shown itself in favor of maintaining the existing tariff on machinery. The minimization of the usual falling off in business incidental to such a year was a cause of genuine satisfaction. Another occurrence which was regarded as a disturbing factor, although the disturbance was within the trade itself, was the effort early in the year to enact into law the Underwood metal tariff schedule which proposed to place machine tools on the free list. This attempt to place American manufacturers on a par with those of Europe, while it had no great effect upon business activity, did arouse a vast amount of uneasiness among manufacturers and dealers and was vigorously combated before the Finance Committee of the Senate at Washington by a large delegation, with Fred. A. Geier, Cincinnati Milling Machine Company, as spokesman. The situation is one which bids fair to repeat itself this year, although it is thought certain by the trade that a measure less radical will be formulated under the new administration.

Some Features of the Year

The year 1912 opened with the quiet which is proverbial about holiday time, but before January was passed conditions began to improve and the month was a good one in point of sales. The publication in the January 4 issue of *The Iron Age* of the Delaware & Hudson list seemed a good augury and so proved. In February the trade was more or less agitated by tariff talk and the concerted protest was at this time made against a reduction of duties. Improvement in this month was more noticeable in the Middle West and South, while New England also became more active. In March healthier conditions were apparent everywhere, though in the latter part of the month there developed a period of hesitancy in placing orders in the East. April was a fair month in the New York market and May also. June was very good and activity mounted to a high level which was very generally maintained until near the close of the year. July and August were extremely good, trade being little affected by hot weather. The latter part of July was marked by increased railroad buying in some sections of the coun-

particularly in Chicago, and in August many firms reached the top notch of the year's activity. Of September and October it can be said that a good steady average of business prevailed and there were intimations that prices on machine tools should be advanced, but there were few advances despite the upward trend in many other lines. Not until a few days of the election was there any slowing up of activity which might have been attributed to that cause, and as already stated the falling off in trade was slight. November was a little less active as compared with some preceding months, but business was much better than at the same time a year previous. The approach of the holiday season in December brought with it less activity, although conditions were generally good, all things considered. The end of the year found the New York trade with some good prospects in view, and there now prevails a spirit of optimism, despite the revival of the agitation for a lower tariff and more or less consequent uncertainty.

Expressions from Railroads as to 1913

In keeping with its yearly practice, *The Iron Age* sent a number of letters to high officials of leading railroads, seeking light as to any plans which might have been formulated with regard to 1913 requirements of shop equipment, extensions of plant, etc. The replies were not as productive of desirable data as was the case a year ago, many of the railroad officials explaining that they had purchased to the extent of their needs in the past year and did not contemplate outlays of importance in the new year, or that decision has not been reached. As pointed out a year ago, many of the roads are pursuing a policy of buying piecemeal, and their statements that they do not foresee buying does not of course mean that they will be entirely out of the market in 1913.

Some of the replies embodied information of an interesting character and a few excerpts from the letters are given herewith:

Rock Island: "Our budget is not made up in detail as yet and we cannot give you detailed information; however, our expenditures are approximately about $125,000."

Illinois Central: "We have just placed orders for about $100,000 worth of machine tools, the most of which will not be delivered until after the first of the year and we do not expect to make up another list before the end of the present fiscal year, which is June 30, next."

Delaware, Lackawanna & Western: "For several years past this company has made large expenditures for the construction of new shops and the equipment thereof with modern and improved machinery * * * to such an extent that during the year 1913 we do not contemplate any extensive expenditures of this character."

Erie: "We have no information at this time (December 5) on which a reasonably accurate estimate of our shop equipment requirements for the calendar year 1913 can be based."

Philadelphia & Reading: "From time to time we buy additional tools for replacing worn-out and antiquated machinery. We are making some changes in the car shops in the vicinity of Pottsville, but definite information cannot be given at this writing."

Central of New Jersey: "This company has just completed its new and extensive car shops at Elizabethport and installed therein a complete outfit of up-to-date machinery."

Boston & Albany: "We do not contemplate replacing machinery excepting to follow out the general policy of placing modern tools in the shops as the old machines are retired."

Delaware & Hudson: "We are about completing our new shops, which were started in the early part of last year, and have nothing new in contemplation in the way of shops or equipment."

Pennsylvania: "It is contrary to our policy to make public anything to show our shop equipment needs for any period."

Western Maryland: "We have under construction new shops at Hagerstown and Cumberland, Md., but as yet nothing definite has been decided upon relating to the interior equipment."

Fort Worth & Denver: "The purchase of additional machinery and the replacement of old machinery will be light."

Mobile & Ohio: "For several years past this company has been re-equipping its shops gradually with new and improved tools, and it is quite likely that this policy will continue during the year 1913."

Chicago, Milwaukee & St. Paul: "This company will doubtless make some additions to its shop machinery during the year 1913, but the plans are not yet sufficiently developed to give any definite information as to what will be done."

Atchison, Topeka & Santa Fe: "Aside from ordinary current expenditures no extensive enlargements of our shop equipment are contemplated. We may build small additions to one or two of our present shops."

New York, Chicago & St. Louis: "Our present expectation is to complete the modern round house at Conneaut on which work was commenced early this season."

Queen & Crescent: "We have materially improved our largest car repair shop during the past two years and have also installed a good many new tools in our various shops."

Nashville, Chattanooga & St. Louis: "Some weeks ago we placed an order for about all the shop tools we will need in 1913."

Ann Arbor: "The question of shop improvements and extensions depends entirely on the money market. We expect to do some work in that line and will do so if the security market will permit an advantageous sale of securities to cover the expense."

Toledo, Peoria & Western: "We seem to have about everything needed in this line, but expect to keep our working machinery up in first class condition."

Chicago & Northwestern: "There are some improvements we would be justified in making but we will have to await the development of business in the first months of the new year. * * * Ordinarily we buy about $50,000 worth of machinery each year to take the place of obsolete articles, etc., and the year 1913 will not be an exception in this respect."

Elgin, Joliet & Eastern: "We are building some new shops, and have placed orders some time since for deliveries of all of the requirement for the first half of 1913."

Wabash: "We have made pretty heavy purchases of shop tools during the past year, not only for replenishing existing shops, but for supplying new locomotive shops now under construction at Decatur, Ill."

Denver & Rio Grande: "It does not seem probable that we will purchase any important amount of machine tools nor make any additions of importance to the repair shops on the line, but in these days of increasing business activity, there is no telling what six months may necessitate in the way of additional facilities."

St. Louis & San Francisco: "It is possible we shall, during the year, erect at Thayer, Mo., a new round house, and we are also considering adding in a limited way to our facilities at Sapulpa."

Missouri, Oklahoma & Gulf: "We contemplate a new machine shop, engine house and car shops at Muskogee, Okla., and expect to let the contract during this month (December). Equipment for this shop will be strictly modern and electric drive throughout; the expenditure being about $100,000."

Missouri Pacific: "We do not contemplate any extensive shop improvements, etc., during the coming year."

Northern Pacific: "Our plans for next year's shop improvements have not yet been perfected."

St. Louis Southwestern: "We recently completed the installation of entire new equipment in our shops at Pine Bluff, Ark. and Tyler, Texas."

Chicago, Milwaukee & Puget Sound: "We have made considerable additions to our shop facilities during the present season, the same, however, not yet being completed."

Canadian Pacific: "The large shop at Calgary which has been started within the year, will be completed and ready for operation in the early months of 1913. A new locomotive shop at McAdam with a capacity of six pits, and steel passenger and freight car shops at Montreal with a capacity of 12 to 15 steel freight cars per day and 15 to 25 steel passenger cars per month, which were commenced during the present year, will also be completed next

spring. We also contemplate some additions to our car repair facilities and possibly the construction of another ten pit locomotive repair shop. * * * At the rate business is increasing it will certainly be necessary to obtain additional facilities."

Grand Trunk: "In the past year this company has purchased something like 150 passenger cars, 8000 freight cars and 150 locomotives, and we do not expect that we will be required to do very much more in this direction during 1913."

Southern Pacific: "We expect to purchase shop tools and machinery to the extent of approximately $40,000 during the first six months of next calendar year."

Baltimore & Ohio: "The probabilities are we will have occasion to replace some of our old equipment in the shops during the coming year, but have made no plans regarding the construction of new shops and do not anticipate any improvements in this direction at the present time."

The Week

NEW YORK, December 31, 1912.

The principal item of interest in the New York machinery market in the last week of the year was the issuance of a fair sized list by the New York Central Railroad which calls for the following machine tools

One 42-in. boring mill.
One 24-in. shaper.
One 16-in. engine lathe.
One 20-in. engine lathe.
One 27-in. engine lathe.
One 32-in. engine lathe.
Two 5-ft. radial drills.
One 4-ft. radial drill.
One 32-in. upright drilling machine.
One Springfield guide bar grinder.
One 42-in. planer.

Inasmuch as bids were called for by December 31 it is believed that buying will not be long delayed if it is not done at once. Aside from the New York Central requirements, business has been pretty much at a standstill. The trade, however, sees no reason for changing its belief that January will bring an excellent movement. As heretofore said several very good prospects which have taken definite form are expected to materialize early in the year. Included among these is a list issued by the Norfolk & Western about the middle of December which includes two large wheel lathes, engine lathes and bolt and riveting machinery and is good for approximately $35,000.

To permit the enlargement of its plant, the Oswego Machine Works, Oswego, N. Y., has purchased land adjoining its property on First street, and plans are ready for the erection of a two and three-story addition. On another part of the property a foundry will be built. The Oswego Machine Works, of which Neil Gray, Jr., is the proprietor, manufactures paper cutting machines for paper mills, printers, paper box makers, etc.

The Board of Trustees of the village of Brockport, N. Y., is receiving bids for $275,000 of water improvement bonds, the proceeds of which are to be used for the construction of a water works system to be built from plans prepared by Witmer & Brown, consulting engineers, Chapin Block, Buffalo.

The Warren Box Company, Glens Falls, N. Y., O. V. Vlitterdorf, president, has plans in readiness for a factory 50 x 130 ft., two stories and basement, of brick construction, with slag roof, which it will erect on Warren street early next spring.

Plans have been filed with the State Health Commission, Albany, for the sewage disposal plant and intercepting sewer to be constructed by the city of Albany at an estimated cost of $1,000,000. Hering & Gregory, 170 Broadway, New York, are the consulting engineers.

The Genesee County Fruit Growers Association is having plans prepared for a cold storage plant to be erected at Batavia, N. Y., to cost with equipment $100,000.

The Larkin Company, Buffalo, N. Y., manufacturer of soaps, perfumes, etc., has purchased land adjoining its present extensive plant at Seneca, Swan and Seymour streets, and will erect a large addition.

Taylor & Crate, Buffalo, manufacturers of and dealers in hardwood lumber, have purchased a site and will build a woodworking plant.

The Dwelle-Kaiser Company, Buffalo, manufacturers and distributors of glass, etc., has purchased a seven-story factory building at Elm and Syracuse streets and will equip it for the manufacture of its products.

The Buffalo Pitts Company, Buffalo, manufacturer of traction engines, road rollers, etc., will build an addition 66 x 146 ft. to its plant at Fourth and Carolina streets and the Erie Canal.

The new plant of the J. P. Devine Company, Buffalo, manufacturers of vacuum drying apparatus, to be built at Clinton street and the Erie Railroad, will comprise a machine shop and erecting building, 90 x 200 ft., a boiler and tank house and an office building—brick and steel construction.

New England

BOSTON, MASS., January 1, 1913.

The year in New England has been one of great prosperity in common with the rest of the country. The improvement accelerated as the months passed and the high mark was reached in the early autumn. The Presidential campaign proved to have no serious effect, but a little later came a slight recession in some lines due to the condition of the money market, a hesitation on the part of some buyers owing to the proposed revision of the tariff, and other influences, and this was accentuated, though not seriously, in the last few weeks by seasonable conditions, notably the holidays and the taking of inventories.

No class of business experienced a greater change in 1912 than that of machine tools and other equipment and supplies which are used in the metal industries. The most important influence was the automobile and motor truck industries with their ramified kindred lines, and consequently the demand was felt first by builders of the newer types of machinery rather than by those who manfactured the older standard lines. Grinding machines, the automatics and semi-automatics, and the more special machines were in greatest demand. As the year progressed, however, everybody engaged in the manufacture of machinery became prosperous. The demand has been uneven, orders as a rule not coming in a steady flow, but rather in bunches. The slacking up, which arrived late in the year, prevented deliveries from getting beyond control, and also had an influence in preventing a general advance in prices, which is inevitable sooner or later, because of the increased cost of production.

Manufacturers and dealers have the greatest confidence in the immediate future. Local banking interests agree with this opinion. The feeling is that the prosperity point in the cycle of business is here; that nothing can impede the trend of the times. A typical expression of opinion is the following quotation from a letter received from a New England builder of engine lathes and other machine tools: "From our point of view business looks extremely encouraging. We are going ahead on the assumption that business for the next year at least is going to be as good as we have seen it for a long time. We have work enough ahead to tax our utmost capacity for the next six months, with a prospect of lots more to follow. People as a rule are shy of the possible results of disturbing the tariff, but we believe that nothing can stop good business now. We have increased our equipment and our crew is the largest we have ever employed."

Following back the curve of business for many years, it is found that the wave reaches the crest of prosperity every seven or eight years. The exceptional circumstance may move the point a little one way or the other, but, generally speaking, the deviation from the rule is slight. Such being the case, 1913 should correspond to 1905 or 1906. It must be kept in mind that business in 1912 has been exceptionally good. Some manufacturers do not seem to realize how prosperous the country has been. The value of manufactured products compares favorably with the best twelve months the nation has ever known. Of course, productive capacity is far greater also, so that the percentage of output to total capacity has not been so great as it was in 1906 and the early part of 1907. Had it not been for retarding influences, notably the slight hesitation in buying caused by the thought of tariff revision, and by others which need not be considered as serious, the probability is the beginning of an actual boom period would have been made before this. Therefore, many observers express satisfaction that the deterrent factors have asserted themselves, the theory being that it is much better that the business be distributed over a longer period.

crops have been good in New England as well as those sections which produce the great volume of food staples. Local prosperity with the farmers is felt somewhat directly by the trade. The influence of the magnificent total of the country's agricultural production is difficult to realize. Economists who have given careful study to the theory of cycles in business, point out that the great crops which are produced year after year without a break should have a corrective influence on the cycle to shorten it. Until comparatively recent years the country suffered from periodic crop failures. Their effect was tremendous. The buying power of the nation was temporarily reduced in a manner which affected every industry. It is believed that such a catastrophe on the gigantic scale of other years is a contingency almost too remote to be considered. The opening of all available acreage in the Middle West has effected certain climatic changes and the influence is being extended still further by the opening of great districts to cultivation by means of irrigation. Thousands upon thousands of square miles of land now yielding large returns were formerly covered by an almost waterproof crust. In times of rain the land absorbed but a trifling part of the water which fell upon it and great freshets resulted. In the summer the rainfall was slight, the Western mountains acting as a barrier. With no moisture stored in the ground and none falling from above, the prairies became as a desert. Now this crust has been broken and the earth converted into a giant reservoir. The result is not only that this water acts upon the growing crops, but local evaporation results in what might be termed local rainfall. Of course, droughts are not unknown, but they are largely local.

If it is true that the crop is now a dependable quantity, a correction, it is argued, should be made in the cycle. If formerly the great loss of a crop failure was included in the period of years, the removal of this factor, meaning hundreds of millions of dollars saved, must be taken into account. Either the waves of prosperity would be brought closer together or fluctuations would be less conspicuous. The latter is the commonly accepted idea. Instead of having the very low spots and the very high spots in the curve, they should be flattened, bringing the high spots lower and the low spots higher. Industry would be much more prosperous on such a basis, making less money in certain years but making more in others and increasing the average. If this deduction is a true one, then the country is on the eve of a prosperous period which should be less boom-like than the last, and of longer continuance.

Labor conditions in New England have been satisfactory except that good workmen are very scarce. Even unskilled help has not been easy to get. Some manufacturing houses would have produced in considerably greater volume had they been able to increase their working forces as they would have liked to do. Generally speaking, the unrest as indicated by strikes, has been confined to the textile industry.

The use of the premium or bonus system in the manufacturing plants has reached a magnitude where it has a tangible influence in the relations of employers and employees of the New England territory, since owners have come to the realization that this system, to be a success, must be based on an unbreakable rate of compensation. That the results are profitable has been established, and the prejudice which has existed on the part of the employee class is rapidly dying out. So far as can be learned, in every plant where bonus or premium is paid in compensation for more efficient effort, unrest has disappeared, the men recognizing that they are receiving more wages than under the old system of hourly wage or piece work, at no excessive increase of physical effort. The fact has been advertised broadly as news travels from shop to shop, and in each successive establishment where the system is installed a higher degree of initial co-operation on the part of the employee is experienced.

There has been considerable increase in manufacturing facilities in this territory as compared to recent years. Many concerns have added buildings and a number of new plants have been erected. The outlook for new construction for 1913 is exceedingly good. Some announcements have already been made and many other plans have been formulated.

The great list of machinery requirements for the new shops of the Boston & Maine Railroad was the feature of the year in the machinery market. The list is the largest ever issued in New England, totaling more than one-half million dollars. The Boston & Maine has made other important purchases for smaller shops, but the New York, New Haven & Hartford, the Boston & Albany and the Vermont Central have not been in the market in any conspicuous way.

The great disappointment of the year was the decision of the Grand Trunk to abandon its projected new lines in the New England territory. However, it is believed that the line partially completed extending the Central Vermont Railroad from Palmer, Mass., to Providence, R. I., will be built. Work was suddenly stopped in the fall, which was the result of a traffic agreement between the Grand Trunk and New York, New Haven & Hartford. A tremendous agitation followed and is making itself felt. If the road is built, undoubtedly it will be necessary to build repair shops on a somewhat large scale.

The demand for wire and rolling mill machinery has been active. The textile machinery industry, an important factor in the local machinery market as a buyer, has revived to a marked extent as compared to 1911. The great shops where electric equipment is built are busy. In fact practically all large local buyers of modern tools should be good customers this year.

The Week

The current week has been quiet for the dealers, which is a wholly natural condition considering that it is Christmas time and the closing of the year. Some of the business that has been taken is with the stipulation that machines shall be billed after the first of year. The trade expresses full confidence that within a few weeks business will be very good, and the expectation is that the buying movement among machinery users will grow stronger as the year progresses.

The Fellows Gear Shaper Company, Springfield, Vt., has just completed an addition which will increase its capacity 50 per cent.

The Sellew Machine Tool Company, Pawtucket, R. I., manufacturer of machine tools, has plans for extending its manufacturing facilities and will double its present floor space.

The E. Horton & Son Company, Windsor Locks, Conn., plans to increase its output very materially, especially on several new lines for which it is having a heavy demand. The purpose is to add at least 50 per cent. to the capacity of the works, particularly through a more intensive system of manufacturing and also probably through additions to machinery and building.

The Milford Iron Foundry, Milford, Mass., has begun the erection of a foundry building, 65 x 100 ft., of steel frame construction, and plans to have the addition ready for occupancy in the spring. Foundations of the buildings were laid last spring and the construction work was deferred until the present time.

The plant of the Mead-Morrison Mfg. Company, Cambridge, Mass., manufacturers of hoisting machinery, was badly damaged by fire, December 27, the loss being estimated at $100,000. The machine shop was destroyed. The company has for several years contemplated the erection of new works and doubtless the fire will hasten the fulfillment of the plan. Several sites have been considered and rumor has it that one has already been chosen.

The Trumbull-Vanderpoel Electric Mfg. Company has established a factory at Bantam, Conn., for the manufacture of knife switches, panel boards, key sockets and other electrical equipment. The company has purchased the business of the Empire Electric Mfg. Company, Plainville, Conn., and that of the Blake Electric Mfg. Company, of Boston, including the equipment, and some new machinery has been purchased. Charles F. Flynn is the president, George Trumbull, vice-president, and Floyd Vanderpoel, secretary and treasurer. Mr. Trumbull has had a long experience in this line of manufacture, having been with Trumble Brothers, of Plainville, and the Connecticut Electric Mfg. Company, of Bantam.

The capital stock of the Cincinnati Steel Castings Company, Cincinnati, Ohio, has been reduced from $100,000 to $50,000, through the retirement of the preferred stock issue. William Gilbert is president of the company.

Philadelphia

PHILADELPHIA, PA., December 31, 1912.

Inventory period as well as the holiday has had an important bearing on the machinery markets. Transactions have been closely confined to cleaning up odd negotiations. Few sales of importance are reported, and the volume of new inquiry is smaller, although some quotations have been asked in order to get a line on costs of prospective tool purchases, not yet authorized. The second-hand machinery market is quiet, being affected by the same conditions as in the general market. Power plant equipment is inactive. Both iron and steel casting plants have been operating irregularly. Little betterment in general business in the machinery markets is expected until toward the middle of the month, when inventory matters will be largely concluded.

Box 341, care *The Iron Age*, Real Estate Trust Building, Philadelphia, Pa., is in the market for a 100 to 200 kw., 110-125 volt, direct current unit, directly connected to high speed automatic engine, in first-class running condition.

William Steele & Sons, architects and engineers, have in preparation plans for an extensive addition to the mill of C. H. Masland & Sons, Ambler and Westmoreland streets. Preliminary plans call for a brick and concrete building, 206 x 240 ft., four stories.

The electric light, power and water station at Delaware City, Del., according to dispatches from that city, was almost entirely destroyed by fire December 27. Harry Clarke and T. B. Heisel are understood to be the principal owners of the plant, which furnished power and light to Delaware City and Fort DuPont, and also supplied the former city with water.

The Imperial Elevator Company, a New Jersey corporation, has leased the first floor and basement of the building located at 923 Locust street, where it will begin, it is stated, a general business of elevator construction.

The Philadelphia & Reading Railroad is taking bids for a coaling station to be erected at Port Reading, N. J., from plans by its own engineer. The plant is to be of steel and wood construction, and approximately 66 x 473 x 38 ft.

A number of local builders are figuring on the construction of a brick and steel factory building, six stories, 100 x 328 ft., with concrete fireproof floors, to be erected in Long Island City, New York, for the General Vehicle Company, from plans by Harris & Richards, architects and engineers, Drexel Building, Philadelphia.

The Keystone Boiler Works, operating at 4640 Umbria street, Manayunk, Pa., has been incorporated with a capital stock of $5,000. Information as to any changes in the present conduct of the business is not available.

Chicago

CHICAGO, ILL., December 30, 1912.

The year just closing has witnessed a decidedly satisfactory volume of machine tool buying in this market. This is especially true of the last six months of the year. For the most part prices have also returned a reasonable profit. From a condition in which the manufacturers were operating about 50 per cent. of their capacity they are now oversold in many instances. In the West the buying of machinery by the railroads has contributed a large proportion of the business placed. Heavy lists have been issued by the Chicago & Alton, Wabash, Rock Island, Illinois Central, Pennsylvania Lines West, Elgin, Joliet & Eastern, and Chicago, Milwaukee & St. Paul railroads, while the Burlington and the Santa Fé have been frequently in the market. The railroad purchases have been of more general benefit in that the railroads have apparently been brought to realize the advantage of considering a wider range of tools and their specifications have been restricted less to those heavier and special machines, commonly accepted in the past as railroad tools. The International Harvester Company's purchases of the year have been considerable, The American Steel & Wire Company were in the market for an important group of machines and the list for the new Busch-Sulzer Bros. Diesel Engine Company at St. Louis was one of the largest of the year. During the past week business has continued more active than is normally expected in December. Of the pending railroad lists most of the heavy machines have been bought but the balance still remains unplaced.

Joseph T. Ryerson & Son are building an addition to their iron and steel warehouses, to be 70 x 200 ft. and to cost $10,000.

The Chicago White Lead & Oil Company has under way the building of its factory on South Western avenue. It will be 80 x 172 ft., five stories, and will cost $100,000.

The Garden City Foundry Company, Chicago, has completed its plans for the construction of its new two-story foundry which will be 100 x 125 ft. and will cost $20,000.

The Central Mfg Company, Chicago, has taken out a building permit covering the erection of a two-story factory 120 x 121 ft., to be erected at 3803 South Ashland avenue at a cost of $66,000.

The Illinois Post Company, Springfield, Ill., has been incorporated with a capital stock of $30,000, the officers being B. F. Bliss, president, F. D. Thomson, P. E. Taintor, vice-presidents.

The G. A. Bauer Company, Chicago, 155 North Clark street, Chicago, has been incorporated with a capital stock of $10,000 to manufacture and deal in electrical machinery.

The Chicago Heights Land Association has closed a contract with the Universal Wrench & Tool Company, a New Jersey corporation with a capital stock of $500,000. The company has acquired five acres of land and a factory building of 50 x 250 ft., two stories, with boiler and engine-house attached, and will at once begin the erection of a three-story building of brick, stone and mill construction 75 x 300 ft., and will equip it with modern machinery. The officers of the company are: Russell D. Clancy, president; R. Y. Bovie, vice-president and general manager, and G. A. Brown, secretary.

The Murphy Mfg. Company, 53 West Jackson Boulevard, Chicago, has been incorporated to engage in the manufacture of machinery by Henry C. Murphy, H. B. Rettie, Wilson H. Bartlett.

The Atlantic Iron & Wire Works, 155 North Clark street, has been incorporated by Benjamin H. Bernstein, Louis Becker and I. B. Rosenstein. The company will conduct a general wire, iron and steel manufacturing business.

The Velie Motor Vehicle Company, Moline, Ill., has increased its capital stock from $600,000 to $800,000.

Brown & Bigelow, St. Paul, Minn., novelty advertising manufacturers, are about to build a three-story factory of reinforced concrete construction which will cost $300,000.

Cleveland

CLEVELAND, OHIO, December 31, 1912

The year 1912, taken altogether, was quite a satisfactory one to local machinery houses and builders of machine tools and of various lines of handling equipment and special machinery. In machine tool lines business with dealers was light during the first few months of the year but a revival started early in the summer, and in the last half of the year orders came out in good volume, making the aggregate business of the year fully up to normal. The demand for cranes in the greater part of the year was very heavy, and builders of other lines of handling equipment enjoyed a prosperous year. Northern Ohio plants took some large orders for cranes for steel plant equipment and these with numerous other orders for small installations have filled plants up in the Cleveland territory with a large amount of work which will keep them busy several months in the new year. There has not been much inquiry for large plants for handling ore and coal but manufacturers of handling machinery have been kept busy with orders for smaller equipment. In the line of handling equipment orders have just been placed with Cleveland concerns for two car dumpers for coal handling plants at Lake Erie ports and another Cleveland concern is building two car dumpers for installation on the sea board.

The machinery market was naturally quiet in the week owing to the holiday season but a fair volume of business is pending, which will be placed early in the year. The outlook in the machinery trade for the early part of 1913 is satisfactory.

The Rogers-Brown Iron Company will add to its ore handling facilities at Buffalo, N. Y., by the erection of an ore bridge. A contract for this bridge has been placed with the Brown Hoisting Machinery Company, Cleveland.

The Ohio Steel Foundry Company, Lima, Ohio, has increased its capital stock from $400,000 to $600,000. The additional capital will be used largely for plant extensions which, it is expected, will be completed during 1913. The company has under way a 100 ft. extension to its main factory building and other extensions will be made as rapidly as possible. The Company has placed a contract for additional machinery

e amount of $40,000, this consisting of cranes and o ton hydraulic press. Other machinery will be d.

The Hardin-Wyandotte Lighting Company, Kenton, o, will build a new lighting plant in that city to cost less than $60,000.

The Novelty Company, Carrollton, Ohio, has com- ced the erection of a new foundry addition 40 x t.

Walter S. Ruff, director of public service, Canton, io, will receive bids January 8 for a steam pump h a capacity of 1,500,000 gal. and a power pump with a capacity of 2,000,000 gal. and an alternating cur- ent motor capable of operating the latter pump against a 240 ft. head.

Detroit

DETROIT, MICH., December 31, 1912.

The year of 1912 has on the whole been a very satisfactory one in the tool and machinery trade. The year started well, and outside of one rather marked lull in the late spring business proceeded in a very even tenor until November, when a gradual slackening was noted. This dulness has now become more marked, and December has probably been one of the lightest months of the year. Depending, as it does, upon the automobile and allied industries for its business the Detroit market reflects their prosperity in a marked degree. The automobile business may be safely said to have passed the boom stage, and manufacturers have been considerably more conservative in ordering new tools and equipment than in former years and fewer new plants have been equipped, but a number of the larger companies have made extensive additions to existing plants and these have been equipped with high class, modern machinery. The automobile accessory business has developed by leaps and bounds and the active extension of established companies and the establishment of many new ones have resulted in the purchase of a large amount of machinery of a widely diversified character. The latter part of the year has witnessed considerable activity in the furniture industry in western Michigan, with a consequent increased demand for woodworking equipment. There has also been a good market during the year for various lines of special machinery, such as handling equipment, sawmill and mining equipment and machinery for use in the manufacture of beet sugar. One bright feature of the year was the excellent condition of the foundry trade, both steel castings plants and gray iron foundries having enjoyed a high degree of prosperity and in many cases having enlarged their facilities. It is also of considerable interest to note that as a rule manufacturing machinists had a good volume of business on their books throughout the year. The building trades have shared in the general activity, the volume of work easily exceeding that of previous years and iron and steel fabricators and makers of contractors' equipment have done a good business.

The past week has been rather listless and orders are few and small. The holiday season is having its effect on all lines, but dealers believe that the depression has reached its low mark and the trend will now be upward. While representative merchants are rather chary of making any optimistic statements as to the outlook for the coming year there is a strong undercurrent of feeling that business is on a sound basis and that it will exhibit a material increase in activity during the next few months.

The Trus-Con Laboratories, Detroit, is erecting an extensive new plant at Caniff avenue and the Grand Trunk Railroad and will make this city its headquarters instead of Chicago, as formerly. The first unit of the new plant is nearing completion and other buildings will be added later. The plant will be equipped with modern machinery for the manufacture of paints and concrete treating materials. R. C. and W. A. Plumb will be in charge of the new factory.

The American Pattern Company, Detroit, is making arrangements to increase the capacity of its plant.

The Wolverine Motor Supplies Company, Detroit, manufacturer of automobile accessories, has had plans prepared for a two-story brick addition to its plant 74 x 84 ft.

The J. C. Wilson Company, Detroit, automobile trimmer, has taken out a building permit covering the erection of a three-story brick factory 50 x 145 ft. to cost $22,000.

It is reported from Port Huron, Mich., that the Anker-Holth Company, which recently established a plant in that city for the manufacture of cream separators, etc., will at once commence the erection of a large addition to its factory.

Cincinnati

CINCINNATI, OHIO, December 30, 1912.

The increase in the volume of business transacted by machine tool builders and other manufacturers in this section during 1912 over the previous year is estimated around 40 per cent. The export trade contributed liberally toward this improvement, although domestic business was measurably better. In so far as the future is concerned a prominent local manufacturer who has a reputation for keeping a close watch on the situation estimates that it is 50 per cent. better than at the close of last year, but this estimate is based on the assumption that there will be no extremely radical tariff laws enacted that would affect the general machinery industries.

The following new plants have been erected in Cincinnati in the past 12 months: The Cincinnati Gear Company, Cincinnati Ball Crank Company, H. L. Brown Fence Company, National Machine Tool Company. The following have either made extensions or remodeled existing buildings for occupancy: The Globe Automatic Sprinkler Company, Lunkenheimer Company, Cincinnati Metal Lathe Company, Lodge & Shipley Machine Tool Company, Norwood Machine Company, Modern Machine Tool Company, King Machine Tool Company, Ideal Steel Wheel Company, Standard Electric Tool Company and the Modern Foundry Company.

The Cincinnati Ball Crank Company is moving its machinery into its new plant at Oakley, and expects to have it in full operation within two weeks.

The C. L. Hils Company, Cincinnati, has been incorporated and will take over the business heretofore conducted by C. L. Hils. The officers are: C. L. Hils, president; R. H. Hils, secretary; H. C. Hils, manager scrap iron department; William Shannon, manager wool and metal department; Thomas Evans, manager paper stock department; John Schardine, traffic manager.

It is quite probable that bids will soon be asked for the structural material necessary for the construction of the proposed Cincinnati Union Depot. Preliminary work has already been started and there will be considerable electrical and other machinery required later on.

The Columbus Machine & Tool Company, Columbus, Ohio, expects to be able to move into its new plant during January. Practically all the necessary machinery equipment has been purchased.

The plant of the Snider Mfg. Company, Logan, Ohio, was destroyed by fire last week. The company manufactures furniture and the loss is estimated around $100,000, with $34,000 insurance. It is the intention of the management to rebuild at once, and if present plans are carried out considerable power and woodworking equipment will be required.

The Charles W. Breneman Company, Cincinnati, manufacturer of building specialties, has had plans prepared for a four-story factory addition that will be 40 x 200 ft. and of reinforced concrete construction. Nothing has yet been given out as to machinery requirements.

Indianapolis

INDIANAPOLIS, IND., December 31, 1912.

The Sullivan Bridge Company, Sullivan, Ind., has been incorporated with $25,000 capital stock to manufacture bridges and other structural iron work. The directors are Robert Taylor, T. J. Walls and M. R. Grutin.

The George Stant Machine Company, Connersville, Ind., has been incorporated with $30,000 capital stock to manufacture machines. The directors are George H. Stant, K. E. Stant and A. L. Stant.

Mark Davis has been appointed receiver for the Whitesides Commercial Truck Company of Newcastle, Ind.

The plant of the Montpelier Cup & Metal Company, Montpelier, Ind., will be sold at receiver's sale January 25.

The General Electric Company will double the capacity of its plant at Fort Wayne, Ind., by erecting a six-story building 140 x 600 ft., which, with its equipment, will represent an expenditure of about $2,000,000.

The Decatur Supply Company, Decatur, Ind., has bought the Dodge paper mill at Delphi, Ind., and will manufacture strawboard and boxes.

John W. Storrs, chief engineer of the Lawrenceburg Roller Mills, Lawrenceburg, Ind., is promoting a company to manufacture a gas engine on which he has been granted a patent.

The Anderson Folder Company, Lafayette, Ind., has been incorporated with $60,000 capital stock to manufacture folding machines. The directors are R. W. Anderson, W. F. Maish and A. H. DeVault.

Summers Bros., Glasgow, Ky., will establish a factory in Indianapolis to manufacture a hydraulic transmission for automobiles.

The Kline-Macy Foundry & Machine Company, Noblesville, Ind., has been incorporated to do a general foundry business. The directors are Charles B. Macy, George C. Kline, E. V. Brigham, Cassius C. Curtis and Harry L. Craig.

The Alexandria Stone Fiber Company, Alexandria, Ind., has been incorporated with $25,000 capital stock to manufacture rock fiber. The directors are M. McKay, J. M. Summers and W. C. Legg.

The Midland Mfg. Company, Laporte, Ind., has been incorporated with $25,000 capital stock to manufacture wooden articles. The directors are J. A. Ross, M. C. Caldwell and J. S. Powell.

The Central South

LOUISVILLE, KY., December 31, 1912.

With buyers engaged in taking inventories and preparing to sum up the results of the year's work before proceding with purchases of additional equipment, the final week of 1912 has been, as expected, an exceedingly quiet period. Machinery manufacturers themselves have been casting up figures and comparing 1912 with its predecessor, and reports of the results are uniformly satisfactory. Substantial increases in the business handled by producers of equipment of all kinds have been recorded, and general agreement is found that 1913 will be even more favorable to business prosperity. The increases which have been scored run in some cases as high as 25 per cent., indicating that though 1911 was a good year, 1912 was a much better one.

Active buying will be resumed in the immediate future, it is expected, now that the holiday languor is about to be dissipated by entrance into a new trade period. In some special lines business will be fixed by developments during the next 30 days. Ice machinery manufacturers, for instance, are watching the weather bulletins to record the amount of natural ice which may be stored this winter, as this will largely determine the amount of new building that will be indulged in by present and prospective ice manufacturers. The demand for equipment for large buildings is quiet at present, as little new work has been coming out, but the general tone of the power equipment field is strong. Electric motors and other apparatus in that division have had a good year, and the demand for them is excellent.

Some of the oil engine people who were disturbed by first announcements of the Standard Oil Company regarding the withdrawal from the market of fuel oil, are now announcing that a cheap grade of kerosene suitable for use in their equipment may be had almost as cheap as fuel oil, and that they also expect the change in the situation to increase the demand for producer gas plants, which are sold in connection with many engines installed in large industrial plants. Consequently the change in the fuel situation is not expected to disturb the oil engine field, but may help the machinery business in the other direction noted.

Birmingham

BIRMINGHAM, ALA., December 30, 1912.

The larger machinery and machine tool dealers of Birmingham report a substantial business even through the holidays and inquiries that warrant expectation of very good trade conditions in the early portion of 1913. Construction work in the trade territory of Birmingham is so varied and of such magnitude as to justify this outlook.

The Peacock Iron Works will, early in January, commence construction at Gadsden, Ala., of a plant for the manufacture of car wheels, castings and mining machinery. The authorized capital stock is $150,000. George H. Peacock, of Selma, is president. It will move its business from Selma, where it is now operating iron works.

The J. B. McCrary Company, Atlanta, Ga., has a contract to install water works and electric lighting systems at Alachua, Fla., at cost of $25,000, and a lighting system for Bowdon, Ga., at cost of $16,000.

A plant for the manufacture of by-products from extensive wood-working plants already in operation is under contemplation by the Kaul Lumber Company, Birmingham, Ala., at its new lumber town near Tuscaloosa.

St. Louis

ST. LOUIS, MO., December 30, 1912.

The machine tool market was of necessity quiet during the week, with little in the way of new business appearing, most of the manufacturers as well as the trade itself being occupied with figuring the year's business and considering plans for the coming twelvemonth. Generally the dealers report a satisfactory year for 1912 and consider the prospects of 1913 very good.

The Polar Wave Ice Company of St. Louis has bought a site in the western part of the city for the establishment of a new branch plant. No plans have been announced as to construction and equipment.

The Steimke Mfg. Company, St. Louis, has purchased a site for the construction of a planing mill to which present equipment will be moved as well as other machinery added.

Fire at Monroe City, Mo., last week destroyed the machine shop of Briscow & Longmiere with a loss of $20,000. Replacement plans are being considered, but have not been announced.

The American Shoe Machinery & Tool Company, St. Louis, is building a new factory on Dickson street to cost $7,000.

The Benner Clay Works, a St. Louis corporation, with a plant at Edwardsville, Ill., has plans for the increasing of the capacity of the plant and rearranging the buildings. The St. Louisans interested are Jules Baron, F. W. Clemens, C. W. Meyer and F. Frommeier.

The Royer Case Lock Company has been incorporated at St. Louis by Ellis S. Royer, John H. De Buhr and C. M. Royer, with $21,000 capital and will manufacture a lock specialty.

Texas

AUSTIN, TEXAS, December 28, 1912.

Notwithstanding the general observance of the holiday season the machinery trade has continued unusually active. Plans for the installation of a number of new manufacturing plants have been made public during the last few days and others are in a tentative shape and will develop into actualities early in the coming year.

The Frankston Gin & Mill Company will install a cotton gin at Frankston.

The Welview Gin Company is preparing to install a cotton gin at Welview.

The McClure Company is preparing to establish a factory at Fort Worth for the manufacture of material for silos and farm machinery. The men interested in the company are Charles W. McClure, Daniel D. Black and A. C. Christopher.

The Garwood Irrigation Company, which has its principal office at Hamilton, Ohio, will construct a large system of irrigation near Garwood, Texas.

The Atascosa Valley Irrigation Company, Pleasanton, has been organized with a capital stock of $120,000 for the purpose of constructing a large system of irrigation near Pleasanton.

The Pacific Coast

PORTLAND, ORE., December 24, 1912.

Machine tool business has been rather quiet for the last fortnight, but the month as a whole has been comparatively good, and an early resumption of buying is expected after the first of the year. Aside from the more or less uncertain prospect of railroad business, it is probable that considerable new equipment will be required by the larger manufacturing plants in this district, and the outlook is favorable for continued activity in a small way. Small shops through the interior have a constantly increasing volume of work, and many new ones are being fitted out.

Manufacturers of logging and lumbering specialties are unusually busy, and a number of new mill and box factory projects are getting into the market for Eastern lines of woodworking machinery. Many mills and camps are closed for the holidays, and before resuming work will undergo a general overhauling, involving considerable new equipment. Some new shipbuilding work is coming out, accompanied by the placing of many orders for gas engines with San Francisco manufacturers. Orders for cannery equipment are much in evidence, both from Alaska packers and from the fruit growing districts, which are rapidly increasing in the north coast states. Plans are also under way for many ice and cold storage plants to be installed before summer. Building has been quiet in the larger cities, but shows signs of improvement, and the development of municipal and public utilities is proceeding actively.